Validation Test Report

The evaluation of the effect of Entropy treated water and beverages on body fat burn metabolism using Lumen carbon dioxide metabolic measurement device

Dr. Chua Chee Yong

Principle consultant
Ellidell BioTechnology Consultancy

February 2021

The evaluation of the effect of Entropy treated water and beverages on body fat burn metabolism using Lumen carbon dioxide metabolic measurement device

Author: Dr Chua Chee Yong

ABSTRACT:

Many medical researches and reports evident the health benefits of fat burn metabolism. Physical exercise that promotes fat burn and other fat burn regimens is therefore widely recommended in healthcare and medical practices. However, physical exercise is rare for people who have medical conditions, who are physically handicapped or people with modern sedentary lifestyle and other constraints. Alternative means of promoting fat burn metabolism would be useful to these people who are physically less active. Entropy treated beverages possess elevated energy for fat burn metabolism and is therefore evaluated qualitatively to determine its applicability. This validation and evaluation test is based on measuring the Carbon Dioxide (CO_2) production in the body exhaling process during breathing. By comparing the molecular structures of glucose and fat, and the amount of CO_2 produced when undergoing combustion with the same amount of oxygen, it is evident that glucose will produce more CO_2 than fat. In normal inhaling breathing, the intake of oxygen into our lungs is almost constant. Thus, by measuring the exhaling CO_2 amount, it can determine whether body metabolism is a glucose or fat combustion. Lumen CO_2 metabolic measurement device is designed based on this exhaling CO_2 measurement principle to determine whether it is fat or glucose contributing metabolism. In this test, Lumen CO_2 meter showed that consumption of Entropy treated beverages promotes fat burn metabolism. Although better fat burn metabolism promotes good health, it does not necessarily result in faster weight loss. As fat burn metabolism is not the sole contributing factor to weight loss, there are many other factors can affect body weight loss greatly.

KEY WORDS: Entropy treatment process, Fat burn metabolism, Portable breath analyzer, Human metabolism

INTRODUCTION:

Lusk G (1923) has revealed that indirect calorimetry has been used mainly for the measurement of metabolic rate. It has been recognized for nearly two centuries that measurement of O_2 consumption (V_{O2}) and CO_2 production (V_{CO2}) can also provide information on the type and rate of fuel oxidation within the body. Under normal circumstances, the computation of substrate oxidations for glucose to produce energy is based on the following equation:

$$C_6H_{12}O_6 + 6\ O_2 \dashrightarrow 6\ CO_2 + 6\ H_2O + \text{Energy}$$

6 moles of O_2 are consumed to produce 6 moles of CO_2 for each mole of glucose (180g) oxidized. 0.76 L of oxygen is consumed per g of glucose and generated 0.76 L of carbon dioxide. The respiratory quotient (RQ = V_{CO2}/ V_{O2}) is thus 1.0. These values differ only slightly if carbohydrates other than simple hexoses are considered.

For the typical fat oxidation to produce energy, the palmitoyl-stearoyl-oleoyl-glycerol (PSOG), is chosen as a representative of Triacylglycerol. The reason for such representation is explained by Hirsch J (1965) in his work on fatty acid composition in normal human adipose tissue. He took the weighed mean of fatty acid as being $C_{17.4}H_{33.1}O_2$; the Triacylglycerol formed from three such molecules would have the approximate formula of $C_{55}H_{104}O_6$. Since PSOG has this formula, it is therefore taken as the representative molecule. Hence, the oxidation for fat uses the following equation:

$$C_{55}H_{104}O_6 + 78\ O_2 \dashrightarrow 55\ CO_2 + 52\ H_2O + \text{Energy}$$

It consumes 78 moles of O_2 to produce 55 moles of CO_2 for each mole of PSOG (861 g) oxidized. 2.03 L of oxygen is consumed per g of PSOG and generated 1.43 L of carbon dioxide. The respiratory quotient (RQ = V_{CO2}/ V_{O2}) is thus 0.704. These values again differ slightly for different fats.

The RQ is conventionally measured directly at the cellular level to estimate metabolic fuel utilization. It usually requires the insertion of a catheter into the vein and artery for a blood sample or taking a tissue sample which makes the RQ measurement invasive and infeasible outside of laboratory setting. With the use of a Metabolic cart, an indirect measure of RQ is made possible by indirect calorimetry through respiratory gas exchange of oxygen and carbon dioxide. Metabolic carts, usually only available in the clinic, are time consuming for assessing the metabolic fuel usage (carbohydrates vs fat). For this qualitative testing, a portable breath analyser operating with the same principle will be adequate. The Lumen breath analyser is therefore selected for such testing. Lorez KA, et al. (2020) in their studies had shown the validity of using the Lumen breath analyser to estimate metabolic fuel utilization in a comparable manner with the industrial standard metabolic cart, providing valid real-time information for users under normal lifestyle circumstance.

Levine JA (2005) has stated in his work that measurement of energy expenditure in humans require assessment of metabolic energy consumptions, fuel utilization, relative thermic effect of different food, drink, drug, and emotional components. There are three components to total energy expenditure in humans namely, basal metabolic rate, thermic effect of food, and the energy expenditure of activity (activity thermogenesis). Each of these components of energy expenditure is highly variable and the total effect of these variances determines the variability in daily energy expenditure for individuals over time. Galgani J and Ravussin E (2008) highlighted that energy homeostasis study has shown and explained the multiple and complex mechanisms on how body regulate energy intake and expenditure to maintain body weight. For weight maintenance, not only energy intake has to match energy expenditure, but also macronutrient intake must balance macronutrient oxidation. However, this equilibrium seems to be particularly difficult to achieve in individuals with low fat oxidation, low energy expenditure, low sympathetic activity, or low levels of spontaneous physical activity. In addition to excess energy intake, his work has explained how the weight gain tendency are affected by the factors as mentioned. Therefore, by increasing fat fuel utilization rate does not equate to weight loss for human body.

For a healthy adult, the amount of glycogen stored in the body is about 400 to 600g. When it exceeds this amount, the excess is normally converted into triglycerides. Some of the triglycerides in the blood stream may be used for energy expense and some stored as body fat. If consistent overeating or excessive sugar and carbohydrate consumption of an individual persists, it will result in weight gain over time. Human body metabolism only switches from glycogen to fat burning when the body glycogen storage is depleted. When this occurs, body will start breaking down fatty acids into ketones as fuel through the ketosis metabolic process. This is beneficial to body as it is drawing down body fat storage. McSwiney FT, et al. (2018) reported burning fat over glycogen has improved the body composition and athletic performance. Other benefits of burning fat over glycogen include reducing the low-grade inflammation and decrease in triglycerides (VLDL, LDL cholesterol contains triglycerides in the lipoprotein block). If triglyceride is reduced, progressively, LDL will be reduced, and HDL cholesterol can be increased. Low grade inflammation is a pathogenetic event of metabolic syndrome, hence parallel benefits in cortisol level reduction, reducing blood glucose, insulin level and blood pressure are manifested. Therefore, fat burn metabolism is a good and correct approach to improve the body health condition.

When human body accumulates excess fat, it results in increased visceral fat wraps around the abdominal organs within the cavity. Furthermore, people with high visceral fat at abdominal area are closely associated with metabolic syndrome or insulin resistance health issue. Accumulating evidence also supports an association between non-alcoholic fatty liver disease and metabolic syndrome. Both visceral fat and fatty liver contribute to great health risk. There are two ways to mitigate this risk. The most important is the reduction of excess fat generation from source by reducing the intake of carbohydrate and sugar. Another way is to perform physical exercise to reduce this excess fat accumulation. However, for individuals who lack exercise, with limited physical activities or with physical disability, consuming beverages with fat burning metabolism promoting effect can be a viable alternative approach to assist in reduction of excess fat.

Since human metabolic processes are biochemicals and energy driven, by consuming elevated molecular energy entropy treated water/beverage may potentially promote fat burn metabolic process. This test is therefore conducted to evaluate this potential.

This is a laboratory-based simulation test for the sole purpose as explained in the abovementioned. It is not a clinical test in any capacity.

SUBJECTS AND METHODS:

Subjects

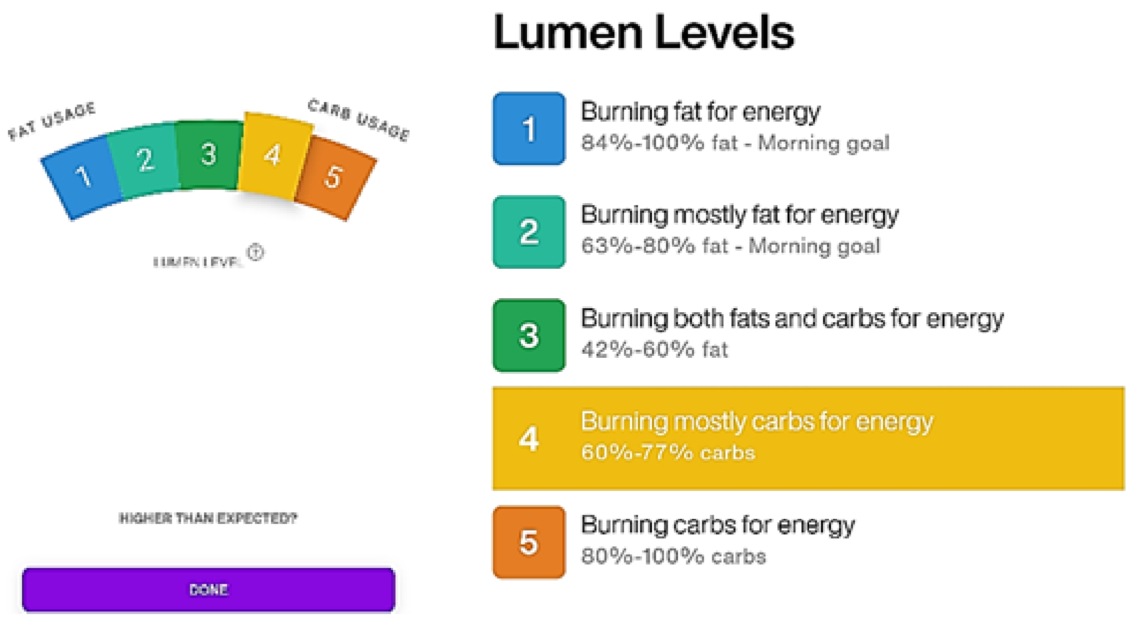
The subject participated for this validity test is a healthy volunteer man of 40-year age. His height is 185cm and 118 kg in weight with a BMI of 34.5. There is no known cardiovascular, pulmonary and/or metabolic diseases reported prior to this test.

Test Procedure

For each testing session for the untreated and treated water/beverage, the subject first took his breakfast meal. After 1.5 hour, his body temperature was measured by the forehead thermal scanner. The Lumen device was paired and synchronized to the smartphone together with the Lumen mobile phone app. Targeted water/beverage was consumed before the Lumen breathing test session was conducted. This testing session was performed on consecutive days for each type of the studied drinks, including untreated coffee/water and treated coffee/water. The quantity and breakfast content remained the same throughout the test period.

Lumen Breathing Maneuver

Each of the Lumen breathing maneuver consists of three phases. The subject took a deep breath in through the Lumen device, followed by a 10 second breath hold. Afterwards, the subject exhaled through the Lumen device, with a steady exhalation flow not less than the starting level of the maneuver. The Lumen smart phone application guided the subject through each phase of the Lumen maneuver. Each Lumen session was repeated after a 5-minute pause interval. Validity of breath maneuvers was systematically evaluated by the Lumen application. The measurement outcome was indicated by a rating of scale 1 to 5. Higher scores closer to 5 indicates the metabolism burns more carbohydrate and less fat. Lower scores closer to 1 indicates the opposite.



Entropy Treatment Process

The Entropy unit (Ecospec NovelTech, 480 W, water chamber platinum emitter with 1 liter capacity, as shown in Figure 2) was turned on and water was filled in the water tank. Water chamber at the touch screen panel was selected and activated the Entropy treatment by pressing the start button. Treated water was collected in the beaker by pressing the dispense button. This treated water was then used for testing purposes.

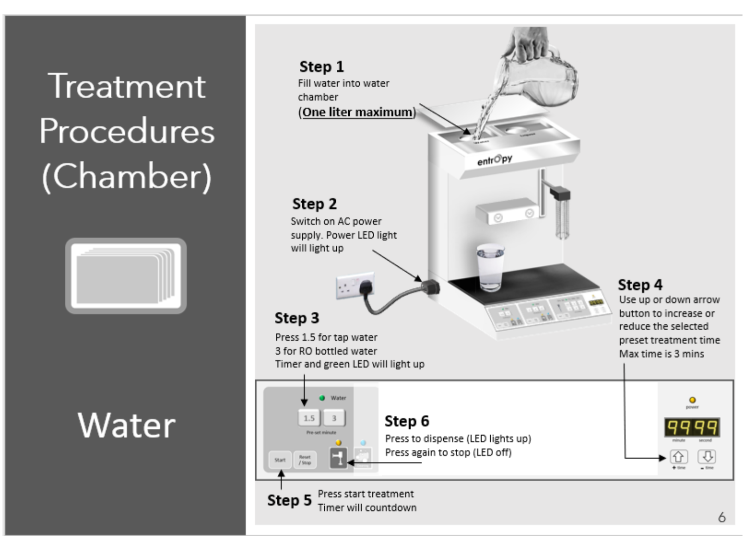
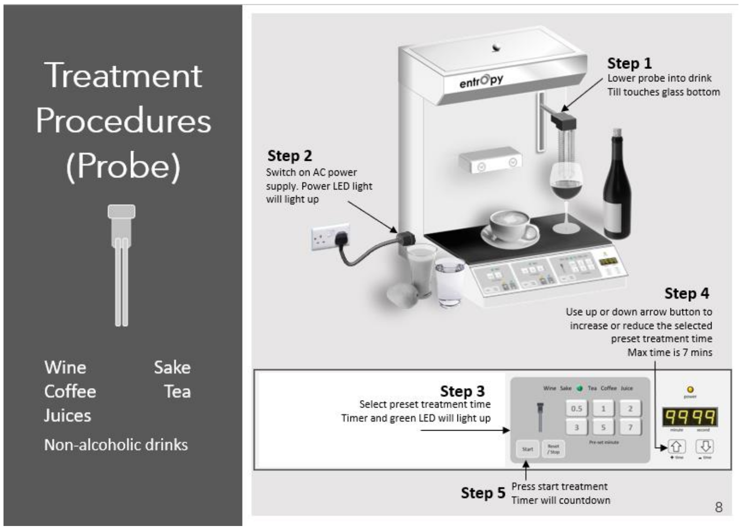


Figure 2 Entropy Treatment Unit

For coffee, it was treated by the probe for 3 minutes on the Entropy unit according to the following procedure.



RESULTS AND DISCUSSION:

The test results for the various untreated and treated water/coffee using the Lumen meter were listed in the following table

Test Number	Time (hour) after meal before commencement of test	Body temperature ^{0}C	Lumen CO2 level before drinking	Lumen CO2 level after drinking	Type of drinks
1	1.5	36.3	5	3	Entropy coffee 200 ml
2	1.5	36.3	5	5	Untreated coffee 200 ml
3	1.5	36.2	5	5	Untreated warm water 500 ml
4	1.5	36.2	5	4	Entropy water 500 ml
5	1.5	36.3	5	4	Entropy water 500 ml
6	1.5	36.3	5	4	Entropy water 250 ml

From the results of test 2 and 3, the Lumen meter scale reading indicates a value of 5 for both consuming untreated coffee and untreated warm water. It shows that the body is burning carbohydrate for energy with 80% to 100% carbohydrate fuel utilization rate. The lumen scale reading changes from 5 to 4 after consuming the Entropy treated water in test 4, 5 and 6. This implies that the body is only using 60% to 77% of carbohydrate for fuel utilization and balance portion of energy provided by fat burning is increased. The same trend of result was obtained for Entropy treated coffee. The lumen scale reading change to the lower values clearly demonstrates that entropy treated drinks promote fat burning metabolism and trigger higher fat fuel utilization rate.

To perform a complete fat or glucose metabolic oxidation process, total activation energy is required to trigger these two processes. However, the amount of activation energy required is different for these two reactions. The total activation energy required by glucose oxidation is lower than fat oxidation. Hence, under normal resting, sedentary or low body activity session, it prioritises glucose burning due to its lower activation energy, the easiest to oxidize to provide body energy. However, when elevated energy water or coffee treated by Entropy is consumed, this elevated energy boosts the body energy level suffices to activate fat burn metabolism even if the subject is at the same sedentary condition. This explained the test results obtained in this validity tests.

The subject has kept himself at similar sedentary conditions, during and throughout the whole test period including meals intakes hours before the test. This is to simulate the usual sedentary lifestyle of a normal working adult and for valid comparison purpose. As glucose and fat burn metabolism can be easily affected by many other factors, a singular subject is chosen for better control and monitoring of metabolic changes. More subjects may be recruited in future tests for broad base evaluation purpose, provided good control over all the subjects can be achieved.

The elevated molecular energy of Entropy water/beverages using FTIR and ORP measurement was validated in a separate validation test conducted prior to this validation test. This report therefore does not elaborate further the energization of water/beverage molecular energy by Entropy treatment.

CONCLUSIONS:

In this validation test, by consuming the Entropy treated water/beverage, the lowering in the Lumen meter scale readings has demonstrated that fat burning metabolism was indeed promoted over carb metabolism even at sedentary conditions. The primary objective of this test is to study and evaluate the possible use of Entropy treated water/beverages as potential alternative mean to promote fat burn metabolism but not as a sole regimen for weight loss or slimming purpose. Although only singular subject is used in this validation test, it does illustrate the underlying principle and depicts the positive effect of using Entropy treated water/beverages as fat burn metabolism regimen. Nevertheless, better fat burn metabolism not necessarily mirror faster weight loss as there are many other contributing factors related to body weight loss.

REFERENCES:

Ecospec NoveTech (2020) Entropy User Manual, Singapore

Galgani J and Ravussin E(2008), Energy metabolism, fuel selection and body weight regulation , International Journal of Obesity,32, S109-S119,Macmillan Publishers Ltd, LA , USA

Hirsch J (1965), Fatty acid patterns in human adipose tissue, In Handbook of Physiology, Adipose Tissue, sect. 5, chapt. 17,181-189, American Physiology Society, Washington, DC, USA

Levine JA (2005), Measurement of energy expenditure, Public Health Nutrition: 8(7A): 1123-1132, Cambridge, United Kingdom

Lorez KA, et al. (2020), Validit of the Lumen hand-held metabolic device to measure fuel utilization in healthy young adults, Cold Spring Harbor Laboratory, bioRxiv Oct 2020, doi: https://doi.org/10.1101/2020.05.05.078980 USA

Lusk G (1923), The Elements of the Sciences of Nutrition, 3rd Edition, 18-25,468-472, Saunders, Philadelphia PA, U

McSwiney FT, et al. (2018), Keto-adaptation enhances exercise performance and body composition responses to training in endurance athletes, Metabolism: 81: 25-34, Elsevier, Amsterdam, Netherlands