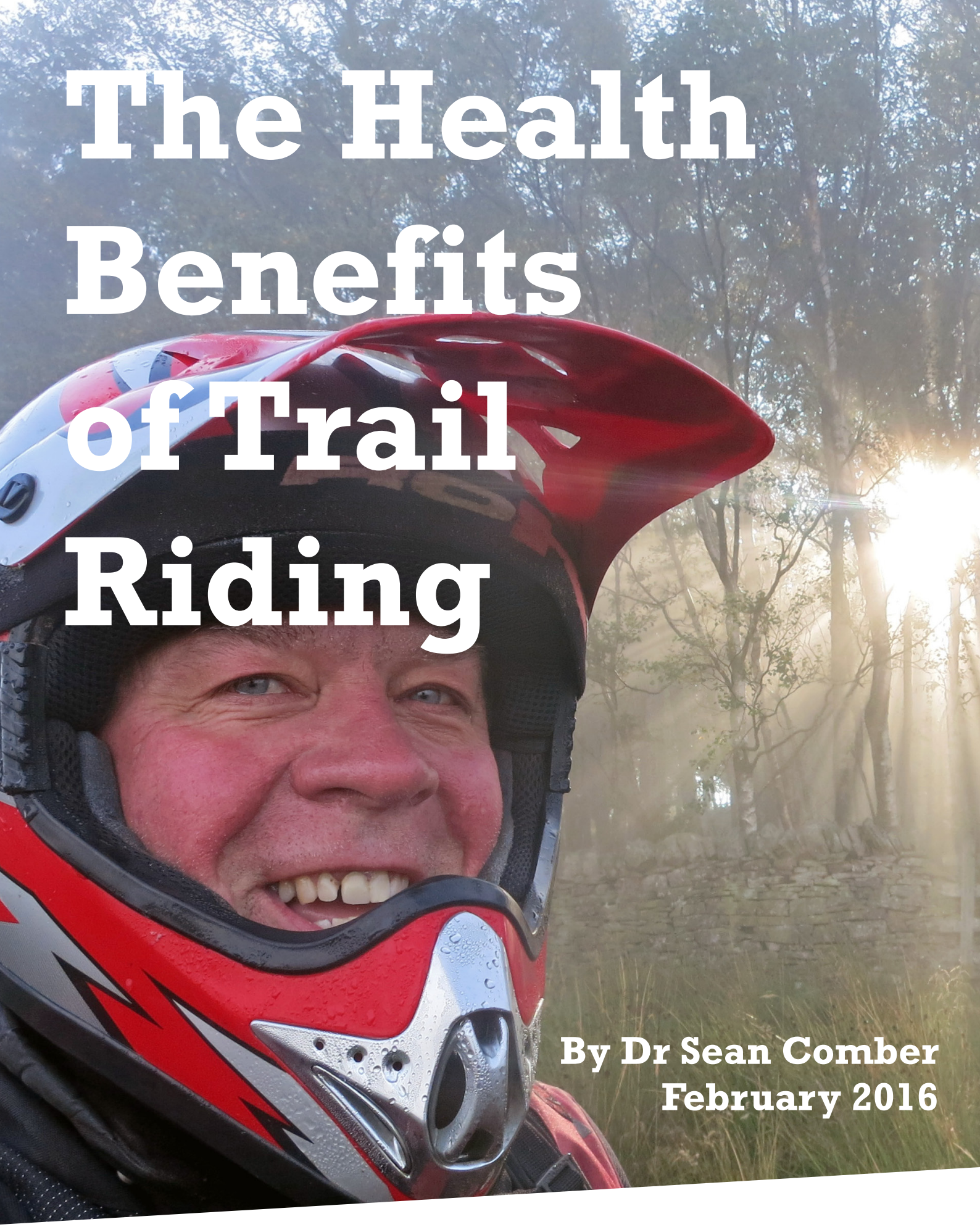
The Health Benefits of Trail Riding



By Dr Sean Comber

February 2016

TRAIL RIDERS FELLOWSHIP

TRF

CONSERVING GREEN ROADS

The Government reccomends you take

150 minutes

of moderate exercise

per week to stay fit & healthy

Trail Riding is classed as above moderate exercise

How many minutes do you spend

Trail Riding

per week?

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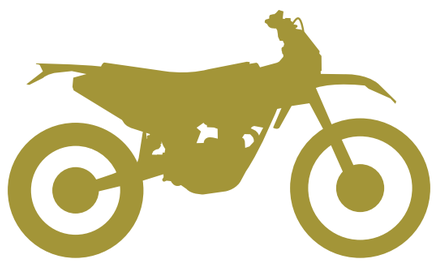

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Summary

The Government recommends targets for exercise in order to remain healthy. It is advised to take either 150 minutes of moderate exercise, 75 minutes of vigorous exercise or a combination of both per week.

Exercise can also be measured in metabolic equivalents (MET)s a scale between 1 (sat in a chair) and typically 12 (high intensity exercise) based on energy used over time. Most rides fall into the "Vigorous" category, with a mean of MET of 6.4 equivalent to downhill skiing or hill walking.

Examining the data in more detail show trail riding to provide both moderate and vigorous exercise. Regarding moderate exercise, data provided in this survey shows that on average a rider will achieve this after a trail ride of 218 minutes (~3.5 hours). The data show that the average ride is 230 minutes in length and that 70% of all rides provide the government recommended moderate exercise in a single outing.

In technical lanes, riders will also undertake vigorous exercise, for an average ride of 230 minutes, a trail rider spends approximately one quarter of their time (56 minutes or 23% of the ride) with their average heart rate working in the vigorous range.

In combination, the moderate and vigorous exercise per average ride adds up to considerably greater than the recommendations, averaging almost TWICE the recommendation (180%). In total 80% of 19 rides evaluated delivered the weekly recommended exercise.

By providing vigorous and in some cases high levels of exercise trail riding provides additional heart exercise and muscle strengthening benefits.

3.5 Hours

The amount of time spent trail riding to reach the Government guidelines for weekly moderate exercise

Introduction

General Health in the UK

As we are all aware, amongst some people that we share the legal rights of way with, we are not the most popular user group and in combination with ignorant governance, it is a continual battle for the TRF to promote responsible use and to maintain vehicular rights of way on our unmetalled roads network.

In many ways this is at odds with Governmental claims of democracy, rights for minority groups and open access to the countryside. Furthermore, a significant amount of effort and money is being expended by the Government on promoting a healthy life style and making use of the countryside around us. This is response to undeniable facts associated with an aging society, increasing obesity and the cost to the National Health Service (NHS) and carers of dealing with the side effects of an ever more sedentary society, including type 2 diabetes, heart disease' cancer and depression (Kim et al., 2007). The estimated direct cost of physical inactivity to the NHS across the UK is £1.06 billion (DoH, 2011).

The UK is officially the most obese nation in Europe (HSCIC, 2015) (Figure 1). Only 66% of males and 56% of women over 19 years of age achieve the recommended amount of moderate exercise per week (HSCIC, 2012).

£1.06 Billion

The estimated direct cost of physical inactivity to the NHS

HSCIC (2015) reports that there was a clear association between meeting the guidelines for aerobic activity and body mass index (BMI) category. 75 percent of men who were not overweight or obese met the guidelines, compared with 71 per cent of overweight men and 59 per cent of obese men.

The equivalent figures for women were 64 per cent, 58 per cent and 48 per cent, respectively. Men and women aged between 45 and 74 are particularly vulnerable to being overweight or obese (NHS, 2012).

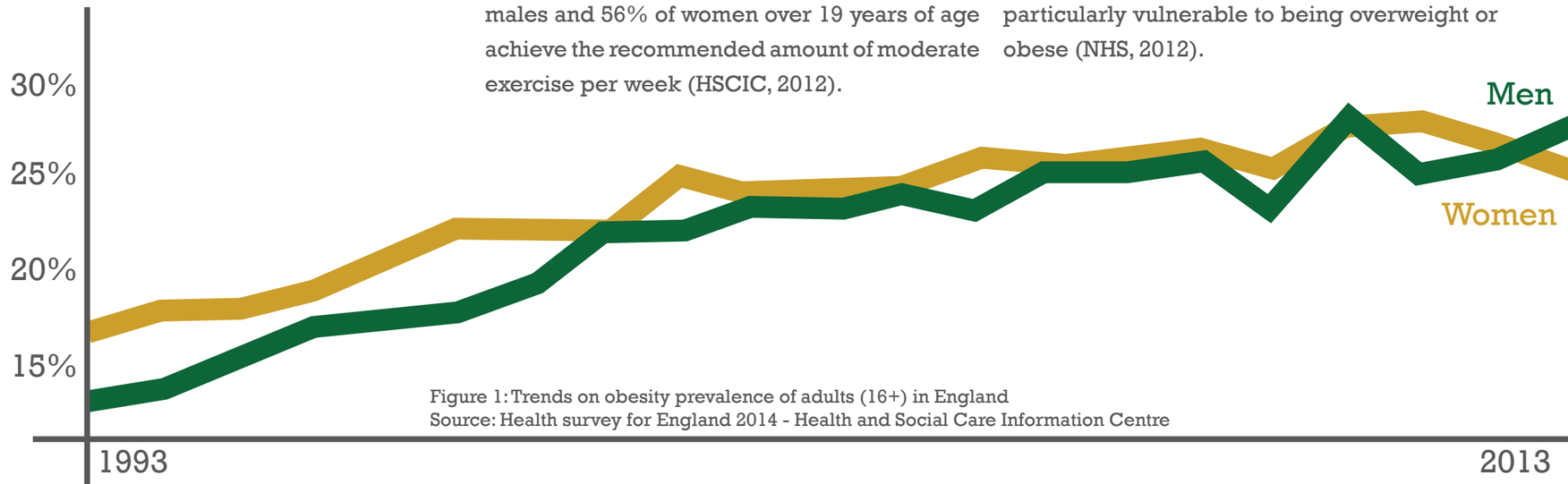


Figure 1: Trends on obesity prevalence of adults (16+) in England
Source: Health survey for England 2014 - Health and Social Care Information Centre

Recommendations for a healthy lifestyle

This issue is recognized by the Government which has promoted a White Paper on healthy living (HM Gov, 2010) as well as reports such as "Start Active, Stay Active" (DoH, 2011), the report states that for adults between the age of 19 and 64:

1) Adults should aim to be active daily. Over a week, activity should add up to at least 150 minutes (2½ hours) of moderate intensity activity in bouts of 10 minutes or more – one way to approach this is to do 30 minutes on at least 5 days a week.

2) Alternatively, comparable benefits can be achieved through 75 minutes of vigorous intensity activity spread across the week or a combination of moderate and vigorous intensity activity.

3) Adults should also undertake physical activity to improve muscle strength on at least two days a week.

4) All adults should minimise the amount of time spent being sedentary (sitting) for extended periods. "Although this is a weekly target, it is recommended that adults should aim to be active every day and therefore spread the 150 minutes across the course of the week. This emphasis on daily activity is based on the scientific evidence indicating that changes such as improved mood, increased insulin sensitivity and favourable alterations in glucose and fat metabolism occur for up to 24–48 hours following activity. Given these acute or 'last bout' effects, adults looking for health benefits should aim to be active every day. Consistent with previous guidelines is the notion that physical activity should be at least moderate intensity."

The report states benefits of exercise include "Activity also provides benefits for well-being, for example improved mood, a sense of achievement, relaxation or release from daily stress. These outcomes can play an important role in improving people's adherence to activity programmes and ensuring that physical health benefits are maintained."

The report draws on USA and Canadian documents:

Physical Activity Guidelines Advisory Committee Report (2008) from the Physical Activity Guidelines Advisory Committee formed by the US Department of Health and Human Services.

Scientific reviews undertaken as part of the Canadian Physical Activity Guidelines review process.

Review papers undertaken as part of the British Association of Sport and Exercise Sciences (BASES) consensus process.

Where needed, individual high quality review papers or individual study papers reporting on relevant issues not covered in the US, Canadian or BASES review process.

Moderate Intensity Activity

Moderate intensity activity stimulates the body's cardiorespiratory, musculoskeletal and metabolic systems and, over time, causes them to adapt and become more efficient. People can tell when their activity is moderate intensity because they will breathe faster, experience an increase in heart rate and feel warmer. They may even sweat on hot or humid days. The amount of activity needed to reach this varies from one person to another. An unfit or overweight person may only have to walk up a slope, whereas a very fit athlete may be able to run quite fast before he or she notices these signs. Over time, a person's fitness level will improve so that in walking, for example, focusing on the perceived effort to reach moderate intensity may mean that their speed increases. Quantified as between 3 and 6 METs (Metabolic Equivalents) – see below for definition.

Vigorous Intensity Activity

Vigorous intensity activity can bring health benefits over and above moderate intensity. A person who is doing vigorous intensity activity will usually be breathing very hard, be short of breath, have a rapid heartbeat and not be able to carry on a conversation comfortably. Quantified as above 6 METs (Metabolic Equivalents) – see below for definition.

The report advocates the benefits of cycling and walking in safe environments. Unsurprisingly, motorcycling on unmetalled roads/green lanes is not listed. This therefore begs the question

"What are the health benefits of trail riding"?

Previous studies on the health benefits of trail riding.

There have been previous reports regarding the benefits of motorcycling.

Kawashima et al., (2014) have proved the following benefits:

Brain function: When riding a motorcycle, the brain of the rider is stimulated. Differences in brain use and level of brain stimulation can be observed in motorcyclists who ride regularly and in motorcyclists who have not ridden for extended periods (at least 10 years). Incorporating motorcycle riding into daily life improves various cognitive functions (particularly prefrontal cortex functions) and has positive effects on mental and emotional health such as stress reduction.

Other reports are available regarding reducing instances of Type 2 diabetes, strengthening knees and necks, mood enhancing, calorie burning and improved core strength, all of these are intuitively correct, though references to scientifically controlled experiments and observations are absent (TBM, 2007). When considering 'off road' riding, the majority of scientific literature pertaining to the physical demands of off-road vehicle riding is specific to "motocross" racing, which is a competitive form of off road motorcycling riding in which riders navigate a track consisting of obstacles and jumps over the course of approximately 30 minute races. Heart rate response associated with motocross racing indicate that this sport is of extremely vigorous intensity and is associated with a considerable metabolic demand and physiological stress (Ascensao et al., 2007; Konttinen et al, 2007 and 2008).

Gobbi et al., (2005) concluded that motocross riders have more muscle mass, higher grip strength, and greater anaerobic power than both enduro and desert rally riders. These results are interesting given that enduro and rally riding are much more representative of typical recreational riding when compared to motocross. The research team also found that desert rally riders tended to be overweight with maximum aerobic powers similar to those of normal, healthy individuals. This study further indicates that motocross-style riding is physically demanding, but may not represent a typical riding situation.

Trail riders using unmetalled legal rights of way in the UK expend a significantly different pattern of exertion, being of generally lower impact, but extended over several hours with potentially more technical sections of lanes which are extremely muddy or present a technical climb up wet and slippery rocky steps for example. Early work by Burr et al., (2006) found that in comparing oxygen consumption rates measured while riding to those measured during an incremental treadmill test to maximum, it was determined that participants worked at a mean rate of approximately 60% of maximum, which was roughly equivalent to jogging in this population. Such a work rate would be considered by both the American College of Sports Medicine (ACSM) and The Canadian Society for Exercise Physiology to be of adequate intensity to increase maximal oxygen consumption, and if performed at sufficient frequency and duration could be associated with health related benefits (ACSM, 1998; Warburton, Nicol & Bredin, 2008).

A more detailed follow on survey was carried out by Burr et al in 2009. The purpose of the study was to characterize the physiological demands of recreational off-road vehicle riding under typical riding conditions using habitual recreational off-road vehicle riders (56 All Terrain Vehicle riders and 72 motorcyclists).

Riders performed strength assessments before and after a representative trail ride (48 ± 24.2 min), and ambulatory oxygen consumption was measured during one lap (24.2 ± 11.8 min) of the ride. The mean VO_2 l requirement while riding an off road motorcycle was 21.3 ± 7.1 mL/kg/min which is comparable to the VO2 required of many common recreational activities. Mean speeds during the typically 24 minute lap of the trail was 25 km/h (15 mph) which is within the TRF recommendations and would not be considered excessive for a UK trail ride.

Analysis of activity intensity revealed approximately 38% of an Off Road Motorcycle riders are within the intensity range (>40% VO_2 reserve) required to achieve changes in aerobic fitness. Riding on a representative course also led to muscular fatigue, particularly in the upper body. It was concluded that on the basis of the measured metabolic demands, evidence of muscular strength requirements, and the associated caloric expenditures with off-road vehicle riding, this alternative form of activity conforms to the recommended physical activity guidelines and can be effective for achieving beneficial changes in health and fitness.

VO_2 is used as an alternative to heart rate, as it is considered a more reliable measure of work rate performed by the body, given that heart rate may be affected by bursts of adrenalin not necessarily linked to improving health. However the report provides a correlation between VO_2 and heart rate (Figure 3) which actually shows a good correlation between the two, which given heart rate monitors are much more readily available than VO_2 meters combined with cost and practicality means that the use of a heart rate monitor for trail riding is an excellent approximation to effort exerted.

The reports key conclusions were:

Using heart rate measurements alone, the demands of riding belong to the category of "hard" exercise – this increase of intensity may be linked to heightened psycho emotional responses (i.e. adrenalin), an effect of heat stress while riding, or a response to repeated isometric squeezing of the handlebars

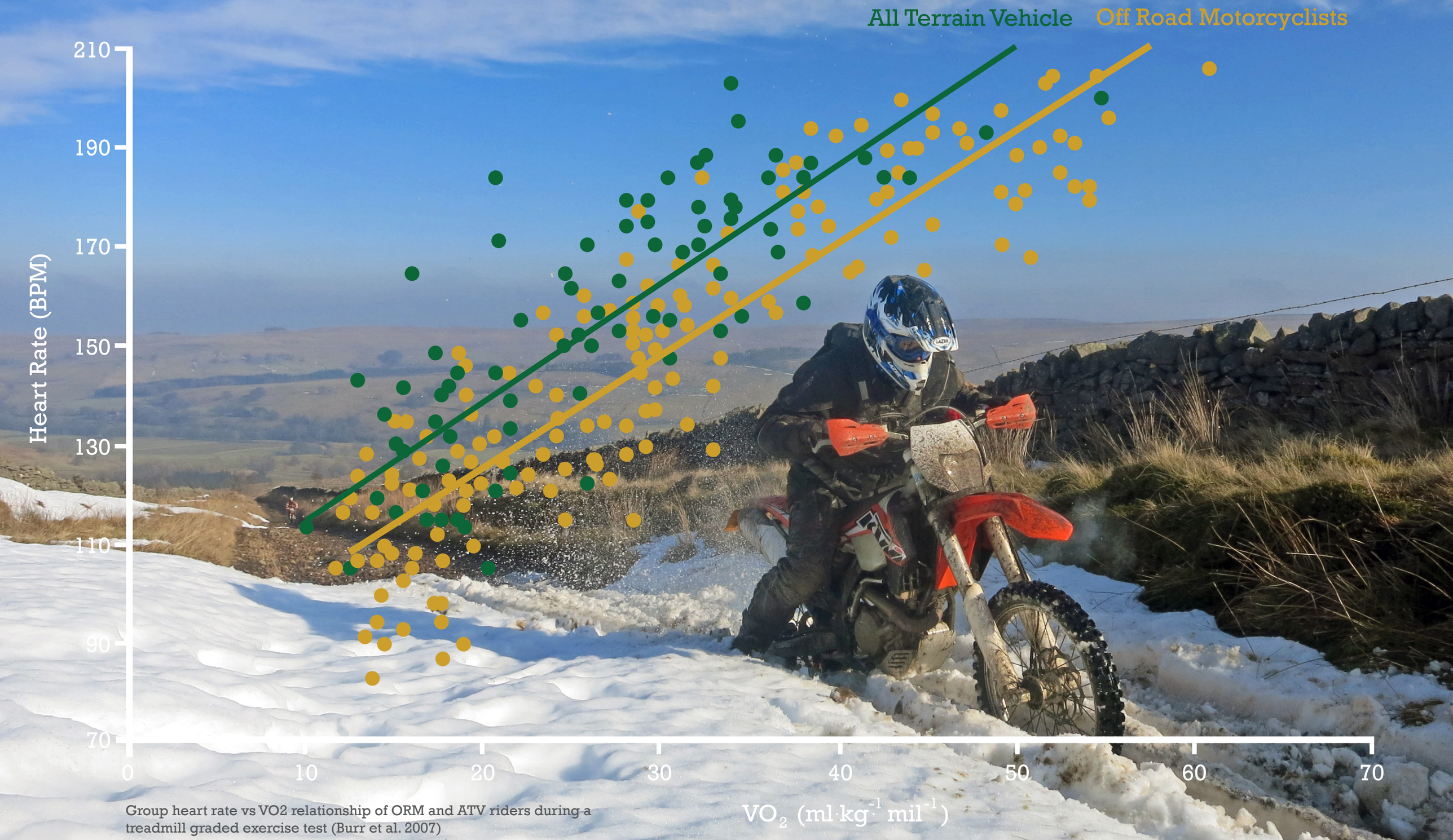
When considering muscular force and power involvement, study results indicate a greater impact on muscular endurance as opposed to an increase in strength

Off-road vehicle riders perform considerable physical work using their arms and upper body which could lead to beneficial training increases in musculoskeletal fitness

Study findings also identified the psycho-social effects of riding, through enhanced quality of life and stress reduction effects of off-road riding

Findings also reflected the importance of alternative physical activity such as off-road riding to promote physical activity in a group who might otherwise forego exercise altogether and that all physical activity is beneficial.

Trail Riding promotes physical activity in those who might otherwise forego exercise altogether. All physical activity is beneficial.



Group heart rate vs VO2 relationship of ORM and ATV riders during a treadmill graded exercise test (Burr et al. 2007)

Methods

The effort expended whilst exercising can be measured in a number of ways; briefly:

Metabolic Equivalents (METS): One metabolic equivalent (MET) is defined as the amount of oxygen consumed while sitting at rest and is equal to 3.5 ml O2 per kg body weight x time (min). The MET concept represents a simple, practical, and easily understood procedure for expressing the energy cost of physical activities as a multiple of the resting metabolic rate. Examples of typical MET levels are shown below.

Measurement of oxygen use by the body, however, is not a simple measurement and so may be converted into calories burnt per unit of time (e.g. kcal/min). Therefore 1 MET = 1.25 kcal/min (Jette, 1990). Road motorcycling has been reported to expend 2.2 METs, which lies between walking at 3 km/h (1.8 METs) and 5 km/hr (3.2 METs) (Jette et al., 1990) and only just above car driving (2 METs).

METs	Type of Exercise
1	Sitting quietly and watching television
2	Walking, less than 2.0 mph, level ground, strolling, very slow
3	Loading /unloading a car
4	Bicycling, < 10 mph, leisure, to work or for pleasure
5	Tennis, doubles
6	Skiing, downhill, moderate effort, general
7	Climbing hills with 0 to 9 pound load
8	Rock or mountain climbing
9	Running, cross country
10	Swimming laps, freestyle, fast, vigorous effort
11	Running, 6.7 mph
12	Fire fighter, general

http://ergo.human.cornell.edu/MetsCaloriesCalculator/MetsCaloriesCalculator.htm

An alternative to measuring calories burnt for each type of exercise, heart rate (beats per minute) normalised to age and rest can also be used. It is widely accepted that the following applies:

Maximum heart rate
= 220-age

Moderate exercise
= 50-69% of your
maximum heart rate

Vigorous exercise
= 70-85% of your
maximum heart rate

High intensity
= >85% of your
maximum heart rate

Heart monitors are easily available and an accurate means of quantifying exercise.

Devon TRF purchased a Garmin Forerunner 15 to test a representative number of trail riders to establish the health benefits under 'real world' riding conditions, rather than around effectively an enduro loop used by Burr et al., (2009). By using a number of subjects and replication across numerous riding conditions it was possible to combine heart rate, calories burnt and BMI data to judge the health impacts of trail riding. The monitor provides data for heart rate linked to GPS details and converts the heart rate to kcal burnt. Based on data collected from trail riders using the heart monitor it is possible to determine calories and heart rates for each day ridden which includes metalled and unmetalled roads. It was also possible to break down the data further to calculate the energy expended within specific unmetalled lanes and varying degrees of technical difficulty (i.e. very muddy or steep and rocky).

The monitor takes average and maximum heart rate at 1 km intervals and also provides a summary for as long as it is activated. Heart rate and kCal burnt/min are related via an algorithm e.g.: Kcal/min = (0.1802 x Ave Heart Rate) – 12.769

It is therefore possible to estimate both the time spent during a ride at % of maximum heart rate or convert to METs via Kcal/min burnt (see Reults).

Results

Data was collected over a 12 month period (2015) for 6 subjects aged between 50 and 65 across 19 varied rides. For some subjects more than 1 ride was recorded. Lanes were predominantly based in Devon, but for one subject (KG) the three rides were carried out in north Wales. Based on a previous questionnaire survey age and BMI of the subjects were typical of the UK trail riding TRF demographic (average age 55, BMI slightly above normal). The table opposite shows a summary of the data collected from 19 rides averaging 229 minutes.

The data show that significant exercise is being achieved whilst riding green roads. The amount of energy expended is variable and related to the technicality of the lanes and the ability of the rider. Some normalisation of data can be achieved by dividing the calories burnt by the time spent out on a ride, this provides a metabolic equivalent (MET) and in all but one ride, at least 3 METs are achieved, relating to moderate exercise, and for 12 of the 19 rides, over 6 METs are expended , equating to 'vigorous' exercise, which is supported by the heart rate data.

The data generated in this survey proves the exercise benefits of trail riding. Average exercise intensity data show that the trail bike rider is working at Moderate Rates of exercise for almost 3 quarters of the time and at Vigorous Intensity for 1 fifth of the time, although it should be noted that there is significant variability around these averages depending on the technicality of the lanes, density of lanes within any given ride and the ability of the rider in question.

Using the well established system of metabolic equivalents (METs), most rides fall into the "Vigorous" category, with a mean of 6.4 equivalent to downhill skiing or hill walking.

Based on the distribution of data, an average ride will deliver the recommended 150 minutes of moderate exercise alone after just over 3.5 hours of riding.

In combination with what is classified as vigorous exercise, an average ride delivers almost twice the weekly recommendation.

The vigorous and occasional high levels of exercise have additional benefits of increased heart exercise and muscle strengthening.

"Promoting physical activity is a core part of our strategies to improve the health of the nation... In particular, encouraging inactive people to take up physical activity in any form, ranging from walking to sport, can have a hugely beneficial effect."

JANE ELLISON MP
Minister for Public Health
Department of Health

Name	Age	BMI	Theoretical Max Heart Rate (BPM)	Ride	Total mins ridden	Total Kcals	% @ Mod Intensity	% @ Vig Intensity	% @ High Intensity	% Total	% Mod + Vig of weekly exercise	METs	METs Equiv
SC	50	26.0	170	1	88	1501	97	0	0	97	57	13.6	Vig
				2	100	815	88	12	0	100	75	6.5	Vig
				3	131	1083	78	22	0	100	107	6.5	Vig
				4	265	2096	81	19	0	100	210	6.5	Vig
				5	209	1712	70	30	0	100	181	6.5	Vig
				6	261	2657	7	88	5	100	268	8.1	Vig
				7	104	1188	73	11	16	100	86	9.1	Vig
				8	266	2020	88	12	0	100	199	6.1	Vig
SF	55	19.9	165	1	246	967	89	2	0	95	126	3.1	Mod
				2	284	1820	90	10	0	100	208	5.1	Mod
LH	55	23.0	165	1	389	3138	80	20	0	100	314	6.4	Vig
KG	38	26.9	182	1	294	2280	65	23	0	88	221	6.2	Vig
				2	185	1595	59	31	4	94	145	6.9	Vig
				3	126	451	39	0	0	39	33	2.9	Light
SH	50	25.2	170	1	359	2932	81	19	0	100	285	6.5	Vig
DB	66	23.5	154	1	343	2534	59	37	4	100	304	5.9	Mod
				2	228	1460	65	35	0	100	205	5.1	Mod
				3	134	663	85	15	0	100	102	4.0	Mod
				4	348	2587	46	39	15	100	288	5.9	Mod
MEAN					229	1763	71	24	2		180	6.4	Vig
s.d.					96	790	22	20	5		88	2.3	

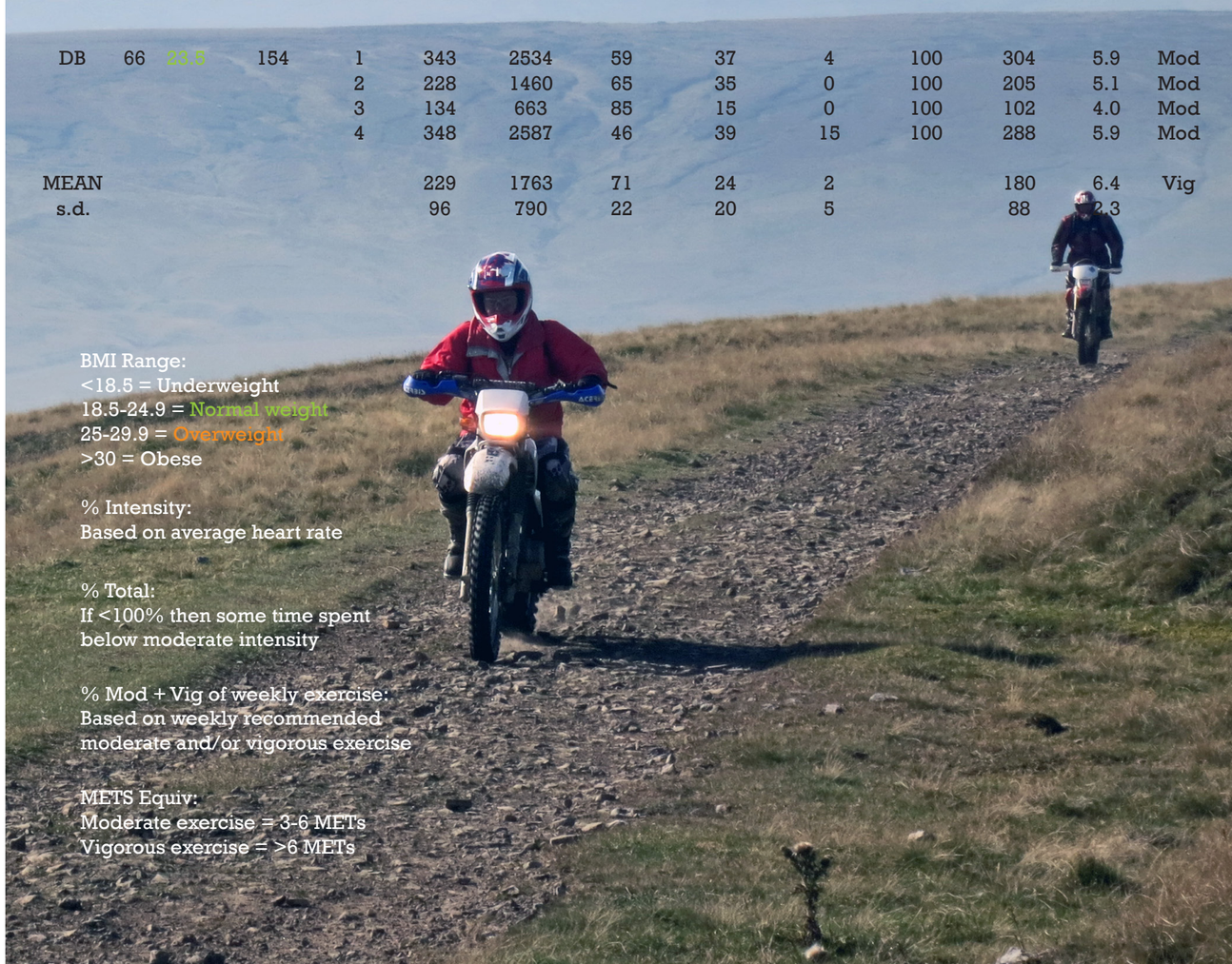
BMI Range:
<18.5 = Underweight
18.5-24.9 = Normal weight
25-29.9 = Overweight
>30 = Obese

% Intensity:
Based on average heart rate

% Total:
If <100% then some time spent below moderate intensity

% Mod + Vig of weekly exercise:
Based on weekly recommended moderate and/or vigorous exercise

METS Equiv:
Moderate exercise = 3-6 METs
Vigorous exercise = >6 METs



Wider Impact

TRF members are definitely men and women of a certain age. The average being 54 years old ±3 years, older than the UK average of 38 years old. This is also a very narrow demographic, but one I believe is typical of the TRF membership. Average height is 5'9" give or take just over an inch which is pretty much the UK average height.

Average weight is 84 kg ±12 kg; which at about 13 stone is the UK average for a man (83.6 kg). From a health perspective, using the body mass index (BMI) calculated as weight in Kg divided by the square of height in metres, the mean BMI is 27. 'Normal' BMI extends to 25, with 27 being classified as overweight. The UK average is also 27. So from a health perspective, the average trail rider/TRF member is basically Joe average, a tad older but nevertheless average height and weight, and slightly overweight. From this point of view, exercise is key to long term health and so trail riding can only be considered a benefit.

5'9"

54 years old

84 kg

BMI 27

From a health perspective the UK trail rider is 'Joe Average'

Exercise is key to long term health and trail riding can only be considered a benefit

"We want everyone to feel that sport is for them, no matter if they are a seasoned athlete or a complete beginner... We should also make sure that people who don't want to be the next Bradley Wiggins or Nicola Adams still feel that sport is for them too. And by giving everyone the chance to participate, we can create a healthier and happier country to live in."

Rt Hon JOHN WHITTINGDALE MP OBE
Secretary of State Department for Culture, Media

Conclusion

Overall what is clear is that a weekly trail ride of around 3.5 hours provides the government recommendation for exercise, albeit in a single day, rather than spread over the entire week.

As a bonus, around 73% of the alternative Government recommendation of 75 minutes of vigorous weekly exercise is also achieved during a typical trail ride.

Get out there and ride, it’s good for you!

References

American College of Sports Medicine Position Stand. (1998).The recommended quantity and quality of exercise for developing and maintaining cardiorespiratory and muscular fitness, and flexibility in
healthy adults. Med.Sci.Sports Exerc. 30 (6) 975-991.

Ascensao A, Ferreira R, Marques F, et al. (2007) Effect of off-road competitive motocross race on plasma oxidative stress and damage markers. Br J Sports Med., 41(2), 101–5.

Burr J., Jamnik V., Shaw J. and Gledhill N. (2008) Conference Proceedings YIHR. Could Participation in Recreational Off-Road Riding.

Burr J., Jamnik V., Shaw J. and Gledhill N. (2009) Physiological demands of off-road vehicle riding.

Official Journal of the American College of Sports Medicine, 42, 7, 1345-1354. DOI: 10.1249/MSS.0b013e3181cd5cd3.

DoH (2011) Start Active, Stay Active: A report on physical activity from the four home countries' Chief Medical Officers. Department of Health, Physical Activity, Health Improvement and Protection. 11 Jul 2011. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/216370/dh_128210.pdf.Accessed 2/1/16.

Gobbi AW, Francisco RA, Tuy B and Kvitne RS. (2005). Physiological characteristics of top level offroad motorcyclists. Br.J.Sports Med. 39 (12) 927-31.

HSCIC (2012) Health Survey for England, 2012. Is the adult population in England active enough? Initial results. Accessed from: http://www.hscic.gov.uk/catalogue/PUB11218/HSE%202012%20-%20Earl%20Resu%20-%20Phys%20Act.pdf

HSCIC (2015) Health & Social Care Information Centre, Statistics on obesity physical activity and diet. England, 3rd March, 2015.

Her Majesty's Government: Healthy Lives, Healthy People "Our strategy for public health in England" (2010). Presented to Parliament by the Secretary of State for Health by Command of Her Majesty, 30 November 2010.

Jette M. Sidney K. and Blumchenjette G. (1990) Metabolic Equivalents (METS) in Exercise Testing, Exercise Prescription, and Evaluation of Functional Capacity. Clinical Cardiology, 13, 555-565. http://onlinelibrary.wiley.com/doi/10.1002/clc.4960130809/pdf

Ji-yeong Kim, Dong-jae Oh, Tae-young Yoon, Joong-myung Choi, Bong-keun Choe (2007) The impacts of obesity on psychological well-being: a cross-sectional study about depressive mood and quality of life. Journal of Preventative Medicine & Public Health, 40(2), 191-195.

Kawashima R et al., (2014) Riding a motorcycle affects cognitive functions of healthy adults. International Journal of Automotive Engineering, 5:73-76.

Konttinen T, Hakkinen K, Kyrolainen H. (2007) Cardiopulmonary loading in motocross riding. J Sports Sci., 25(9), 995–9.

Konttinen T, Kyrolainen H, Hakkinen K. (2008) Cardiorespiratory and neuromuscular responses to motocross riding. J Strength Cond Res., 22(1), 202–9.

NHS (2008) Health Survey for England, 2008. Physical activity and fitness. Summary of key findings. Available at: http://www.hscic.gov.uk/catalogue/PUB00430/heal-surv-phys-acti-fitn-eng-2008-repv1. pdf

TBM (2007) Back on track. The state trail bike strategy. A sustainable future for recreational trail bike riding in Western Australia. Prepared by: trail bike management Australia. Version: 1.0. December, 2007.

Warburton DE, Bredin SS, Horita LT, Zbogar D, Scott JM, Esch BT and Rhodes RE. (2007). The health benefits of interactive video game exercise. Appl.Physiol.Nutr. Metab. 32 (4), 655-663.

The Health Benefits of Trail Riding was researched and written by Dr Sean Comber.

It is part of the Trail Riders Fellowship mission to conserve Green Roads in the UK.

Find out more about the health, economic and social benefits of trail riding at www.trf.org.uk

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Designed by Greg Villalobos for the TRF

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