



Characterizing the Physical Demands of Off-Road Motorcycling

Executive Summary

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(Does participation in off-road motorcycling have reasonable energy demands to be considered a legitimate form of exercise?)

BACKGROUND

In the province of Ontario and worldwide, there has commonly been a difference in opinion between off-road motorcycle enthusiasts and health policy makers as to the potential exercise related health benefits of this sport. As a result, disputes have existed for the sport's future regarding land-use, funding and government support.

PURPOSE

This pilot study used a small population of riders (both novice $n=6$ and experienced $n=6$) to characterize the physical demands of participating in Off-Road Motorcycle riding and to determine if further research is warranted. When characterizing the energy demands, comparisons were made between novice and experienced riders to determine if a difference in skill changed the related exertion. The results were also used to determine if health benefits could reasonably be expected from participating in the sport.

METHODS

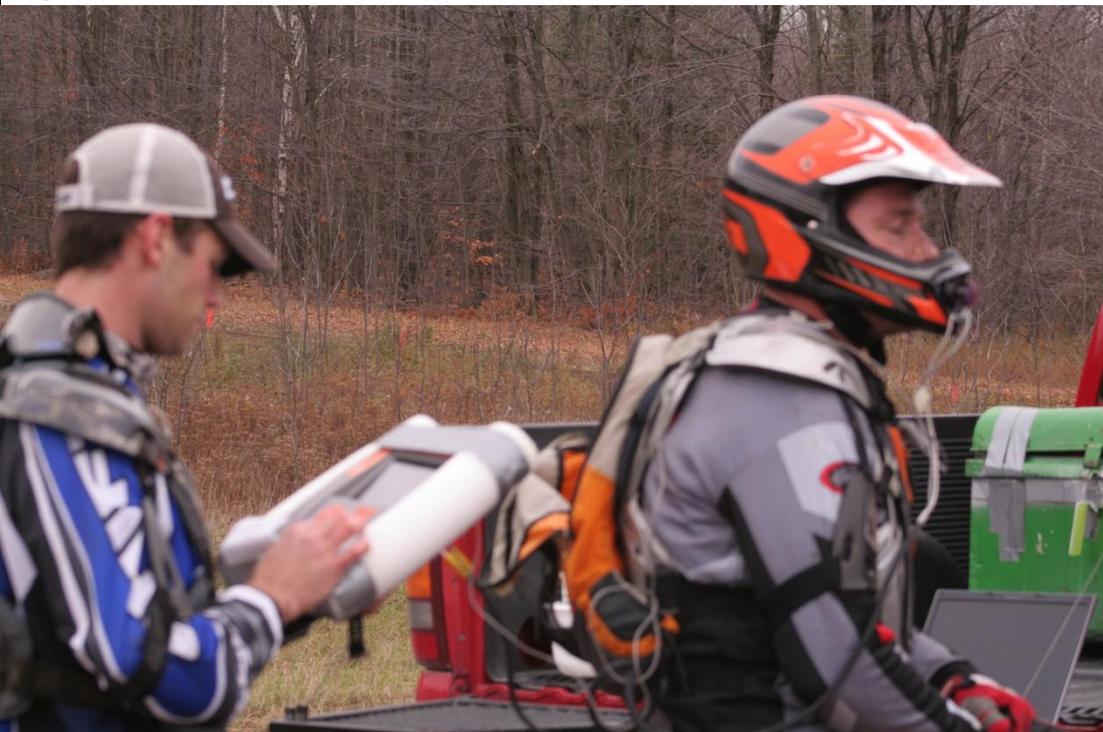
Field data (while riding) was collected on all 12 riders using heart rate monitoring on representative terrain. The experienced riders were competing in an enduro-style event while the novices were first accommodated to the machines at a professional riding school and then self-selected their pace while riding single track trails and/or an open course. All 12 riders were later invited to the human performance laboratory at York University where measurements were made using a graded treadmill test and open gas spirometry to determine oxygen use (VO_2) while walking, jogging, running and at maximal exertion. Anthropometric, strength and power measurements were also taken in the lab. Heart rates while riding were then used to predict oxygen consumption based on the linear regression of heart rate and VO_2 from the lab measurements. Four participants were also measured using portable VO_2 equipment while riding to validate the measurement of a field VO_2 against the lab measures.



Human Performance Laboratory at York University

STATISTICS

All statistics were performed using MS Excel and SPSS 13.0. Group characteristics were compared using t -tests. Linear regressions were calculated for each subject separately and oxygen consumption was determined at each exercise level (walk, jog, run, ride). These levels were used to calculate percentages of maximum as well as group level means. Pearson correlation was used to compare the level of agreement between the lab and field VO_2 measurements.



VO2 max field testing

RESULTS

Comparisons of the novice and experienced riders revealed no significant differences between the groups on age, anthropometry, strength or power measurements with the exception of left hand grip strength and pull force. Due to this lack of difference, the groups were collapsed into one large group for the remainder of the analyses. The average heart rate while riding was 146 beats per minute (bpm) which reflects a VO₂ of 32.6 ml/kg-1/min-1. Given that the mean VO₂ max of the group was 54.1 ml/kg-1/min-1, this means that on average the riders were working at approximately 60% of their maximal capacity. When the O₂ cost of each stage of walking, jogging and running were analyzed for the same subjects, jogging (3.7-5mph) was found to be slightly less strenuous at approximately 57% of max.

The Pearson correlation to validate the assessment of aerobic capacity using portable measurement compared to direct lab measurement revealed an agreement of r=0.99. That suggests that over 98% of the variation can be explained from one technique to the other.

CONCLUSIONS

The results of this pilot study suggest that participation in off-road motorcycling requires physical exertion that would generally be considered within the range of hard to vigorous exercise. As such, it is very likely that participation in this sport within the recommended time and duration guidelines for improving physical fitness could lead to health related benefits including increased aerobic capacity, decreased cardiovascular risk factors, improved musculoskeletal fitness and decreased risk of overweight or obesity. However, despite the positive findings, further research involving larger subject numbers and examining riders over a longer period of time need to be conducted to confirm these results.

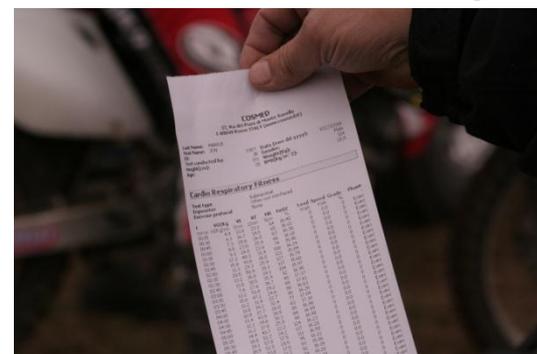
In summary, the results of this initial pilot study provide encouraging evidence that off-road motorcycling is a physically active sport, which has the potential to result in improvements in physical fitness. Further research is warranted to support these initial observations.



Portable VO₂ testing computer



Modified Helmet for VO₂ testing



Real-time positive results

How does this apply to Canadians?

Despite overwhelming evidence as to the health benefits of physical activity, Canadians are not sufficiently active.

Sourced from: Ministry of health Promotion, Active 2010 - Community Physical Activity Planning: A resource Manual for communities preparing plans. 2005.

- In Ontario (2003) almost **50%** of adults were overweight or obese. (CFLRI,2004).
- Only **21%** of Canadian Children are accumulating recommended amounts of exercise (Chief Medical Officer of Health report, 2004)
- Many youth stop participating in sports when they enter their teens and **56%** are inactive (CCHS,2001)
- The annual economic burden of physical inactivity in Ontario has been estimated to be **\$1.8 billion**. (Katzmarzyk et al.,2001)

The Ministry of Health Promotion's has developed the "Ontario Trails Strategy" that recognizes a diversity of motorized trail activities, including those supported by OFTR.

To motivate Ontarians to become more active, both traditional modes of exercise and new possibilities need to be explored. One such possibility is off-road motorcycle operation. The OFTR played an active role in developing the "Ontario Trails Strategy"

In an effort to increase levels of physical activity, the Ontario government is investing 5 million dollars a year to improve the awareness of the benefits of Physical Activity in conjunction with ACTIVE 2010 which aims to increase activity levels from **48%-55%** by 2010.

The test riders were working at approximately **60%** of VO₂max, or **80%** HRmax, or **9.3 METS**

	Category	Recommended frequency & duration
Canada's "Health and Fitness Benefits of Physical Activity Performance"	Vigorous 75-90% Maximum HR max	20-30 min 4-7 d/wk
ACSM position stand on the "recommended quantity and quality of exercise"	Hard 70-89% HR max, 7.2-10.1 METS. Potential for increase in VO ₂ at this intensity	20-60 min 3-5 d/wk

Pilot Study Measurements

Mean HR while riding – 146 bpm
 Mean VO₂ while riding – 32.6 ml.kg.min-1
 Mean VO₂max – 54.1 ml.kg.min-1
 % of Max capacity while riding – **59.8%**

	Mean VO ₂	% VO ₂ max
Walk	14.3	26.5
Jog	30.8	56.9
Run	46.9	86.7

Results – O₂ Cost of Riding (n=12)