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Deer hunting: An innovative teaching paradigm to educate Indigenous youth about physical literacy

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Abstract

Introduction: Many Indigenous youth do not have the opportunity to participate in traditional hunting practices. These skills are being lost to colonial conveniences that negatively influence physical activity (PA) participation and health. ***Objective:*** Understand the contribution of PA for health and fitness through deer hunting as a means to improve physical literacy (PL) among Indigenous youth. ***Methods:*** Case study and proof of concept, demonstrating the feasibility of an Indigenous youth learning about PL through deer hunting. ***Results:*** Deer hunting requires both low and high-intensity PA. In a single day, this individual easily surpassed the Canadian Physical Activity Guidelines (CPAG) for adults of 150 min/week by accumulating 161 minutes of moderate PA. On day-2, he accumulated an additional 114 minutes of vigorous PA. However, almost 60% of all reported PA was performed at a low intensity, indicative of sedentary behaviour. Experiential learning opportunities, like this, provide a unique opportunity to learn about the components of PL. ***Conclusion:*** Deer hunting exceeds CPAG PA thresholds required to maintain health, despite large portions of hunting activity being sedentary. This innovative teaching paradigm provides an effective learning opportunity to promote PL.

Keywords: Physical literacy, Indigenous learning, physical activity and health, hunting

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Introduction

Indigenous cultures have a rich history of being engaged in purposeful and demanding physical activities (PA) for the gathering of food and fuel on a daily basis. The PA of hunting and gathering food was a necessity of Indigenous life, keeping them relatively free of chronic disease (Dapice, 2006). However, the arrival of colonial

civilisation contributed to the loss of cultural identity and practices, such as hunting, that had traditionally required higher levels of physical fitness and skill (Rode & Sheppard, 1994). Arguably, traditional activities such as hunting and gathering food for sustenance require substantial physical literacy (PL) skills. Physical literacy is defined as having the "motivation, confidence, physical competence, knowledge and understanding to value and take responsibility for engagement in physical activities for life" (International Physical Literacy Association., 2015, p.1), and is considered to be a promising strategy to increase PA participation among children, youth, and older adults (Jones et al., 2018). However, experiencing and understanding these components of PL, as they apply to Indigenous culture, has almost been lost. This is especially true among younger generations who have the highest rates of sedentary behaviour and little knowledge of how to be physically literate (Foulds, Rodgers, Duncan, & Ferguson, 2016). Incorporating good health behaviours through the sharing of knowledge between Elders and youth positively influences community wellbeing (Varcoe, Bottorff, Carey, Sullivan, & Williams, 2010).

In most communities, Elders can recall the physical demands of living-off the land for survival. The primal instinct for survival once provided Indigenous people with the motivation and confidence to become competent hunters, using their knowledge and understanding to take responsibility for having a successful hunt. However, most Indigenous communities have moved from being a physically literate culture to one that has become sedentary and reliant upon colonial conveniences (Katzmarzyk, 2008). The opportunities for sustained, vigorous, physical activity are almost completely lost in most Indigenous communities. Resulting in severely reduced levels of cardiorespiratory fitness across all North American Indigenous populations (Hedayat, Murchinson, & Foulds, 2018).

This recent transformational change, from being a physically active culture to one that is relatively sedentary, is primarily responsible for poor health status observed across Indigenous cultures and age groups (Kriska, Hanley, Harris, & Zinman, 2001). Indigenous populations have greater morbidity and mortality rates than the general population (George, Jin, Brussoni, & Lalonde, 2015; Tjepkema, & Wilkins, 2011), and these health-related challenges are also responsible for elevated levels of sedentary behaviour. Greater levels of sedentary behaviour are directly responsible for the earlier onset of cardiometabolic diseases, often prevalent in Indigenous youth and young adults, where upwards of 50% already have adult onset diabetes (Turin et al., 2016). The prospect of improving the overall health and wellbeing of Indigenous youth, through innovative and culturally specific education strategies, is likely the best practice for making a positive and effective change in the health behaviours of Indigenous people (Rolleston, Doughty, & Poppe, 2017).

The contribution of PA to health and fitness within Indigenous culture is well known (Young & Katzmarzyk, 2007). However, these health and fitness benefits are dependent on the intensity at which it is performed. Physical activity of light to moderate intensity will provide some health benefit, but moderate to vigorous PA engenders both health and fitness. Although improved health will assist to prevent and/or treat disease (e.g., diabetes), it is fitness that provides resilience to health events (e.g., heart attack) and the functional independence to support overall quality of life. The Canadian Physical Activity Guidelines (CPAG) recommend that all Canadians accumulate a minimum of 150 minutes per week of moderate to vigorous intensity PA (Canadian Society for Exercise Physiology [CSEP], 2011). Hunting on foot over uneven terrain provides a sufficient intensity (moderate to vigorous) to meet the CPAG (Peterson et al., 1999) and therefore, is considered an appropriate PA opportunity to engage Indigenous youth and benefit their overall health and fitness while participating in a culturally relevant activity. In addition, hunting provides holistic health benefits through improved mental health and a sense of belonging (National Collaborating Centre for Aboriginal Health [NCCAH], 2013).

The purpose of this case study was to expose an Indigenous youth to the concept of PL through the traditional PA of deer hunting. We hypothesised that the majority of the hunt would be completed at low PA levels, while there would be short portions of the hunt that would require

more moderate intensity PA. We expected that it would take at least two days of hunting to achieve the recommended minimum levels PA of 150 min/week, as outlined in the adult CPAG. The aim of this case study was to demonstrate an experiential learning opportunity to understand the different contributions of PA, duration and intensity, completed during a 2-day deer hunting expedition. The goal was to enhance recognition of the health and fitness value of higher intensity PAs performed during a deer hunt (e.g., hiking, butchering), compared to sedentary activities (e.g., sitting, driving). The experiential model of deer hunting was used as an innovate learning paradigm as it would encourage PL through learning about the motivation, confidence, physical competence, knowledge, and understanding of the value of PA required for a successful hunt. Hunting provides an opportunity for learning about PL through the lens of traditional cultural activities practised in the natural environment.

Methods

The participant was male, 24-years of age, of Indigenous heritage, and in good health. He was instructed on how to use a Polar A300 heart rate monitor wrist watch and chest transmitter strap to record his heart rate (HR) continuously over the course of the 2-day hunt. To establish the intensity of PA performed, the participant calculated their age-predicted maximal heart rate (HRmax) using a common formula (i.e., 220 - age). The participant's age-predicated maximal heart rate was 196 beats per minute (bpm). Upon waking, over five consecutive mornings prior to the hunt, the participant recorded his resting heart rate (HRrest) while remaining in a supine position. The average resting pulse, over the five days, was used as his resting heart rate (60 bpm). The heart rate reserve (HRR) method (i.e., % of target intensity [HRmax – HRrest] + HRrest) was used to calculate the intensity percentage achieved at each level of PA (sedentary, light, moderate, and vigorous). These percentage values are consistent with current guidelines (CSEP, 2011) and were used to determine the actual HR range for the individual participant (*see* Table 1). Each PA intensity, relative to the HR response, confers a relative health and fitness benefit. For example, PA performed within the light to moderate range will provide a fair to average health benefit, whereas vigorous PA will likely provide both a health and fitness benefit. Creating these HR zones was important to teach the participant how PA performed at different intensities would engender health and/or fitness benefits or not.

The participant kept a detailed PA logbook to record all qualitative information regarding the types of PA performed throughout the day. These qualitative data were time-locked with the average heart rate recordings sampled between each PA record, on days 1 and 2 of the hunt (*see* Table 2 and Table 3). A new record was entered into the logbook each time the type of PA changed. The average heart rate sampled between each logbook entry corresponded to the heart rate for that specific PA. For example, if the participant moved from sitting in his truck to walking across a field, then the average heart rate from onset of the activity (sitting in truck) until

Table 1. Physical activity intensity related to fitness, percent heart rate reserve, and heart rate

PA intensity	Contribution to Health and Fitness	% Range of HRR	Participant HR limits (bpm)
Sedentary	Poor	<40	<100
Light	Fair	40-55	100-135
Moderate	Average	55-70	135-155
Vigorous	Excellent	70-<90	>155

Note: PA = physical activity; HRR = Heart Rate Reserve; HR = Heart Rate; bpm = beats per minute
Qualitative values of sedentary, light, moderate, and vigorous (Column 1) and the intensity's contribution to health and fitness (Column 2); corresponds with the HRR range (Column 3), and the participant's heart rate limits (Column 4).

the start of the new PA (walking) was used as the corresponding HR response for sitting in the truck. Heart rate recordings were downloaded to a spreadsheet after the hunt and cross-referenced to the PA logbook information.

Table 2. Day 1 physical activity log: Time of day related to duration and average heart rate for each recorded activity

DAY 1	Time (hour)	Duration (min)	Intensity Avg. HR (bpm)	Description of PA
AM				
	6:00	60	63	Sitting in truck
	7:00	20	67	Road hunting; driving into hunting area; coffee
	7:20	40	74	Getting out of truck; opening gates
	8:00	60	81	Getting out of truck; spotting deer, tracking
	9:00	40	64	Driving between hunting areas
	9:35	5	107	Walking through fields
	9:40	6	115	Walking through fields
	9:46	4	128	Walking uneven terrain
	9:50	6	131	Walking ravines/hills/gullies
	9:51	1	152	Walking Uphill
	9:52	8	157	Stalking deer , shoot deer
	9:59	8	132	Cleaning the deer
	10:07	7	167	Dragging deer 50 meters to a pick-up point
	10:14	15	154	Walk back to the truck
	10:31	10	83	Sitting in truck, driving to pick-up deer
	10:45	5	154	Loading deer into truck
	10:50	30	71	Moving between hunting areas
	11:20	35	143	Walking through forest area
PM				
	12:00	75	64	Driving between hunting areas
	13:15	40	133	Walking through fields/hills/forested areas
	13:55	65	135	Walking through fields/hills/forested areas
	15:00	55	63	Drive home
	15:55	40	137	Unloading deer/skinning and fixing meat/hanging meat

Min= minutes; Avg. HR = Average Heart Rate; bpm=beats per minute

HR<100	Sedentary	HR 100-135	Light	HR=135-155	Moderate	HR > 155	Vigorous

Table 3. Day 2 physical activity log: time of day related to duration and average heart rate for each recorded activity

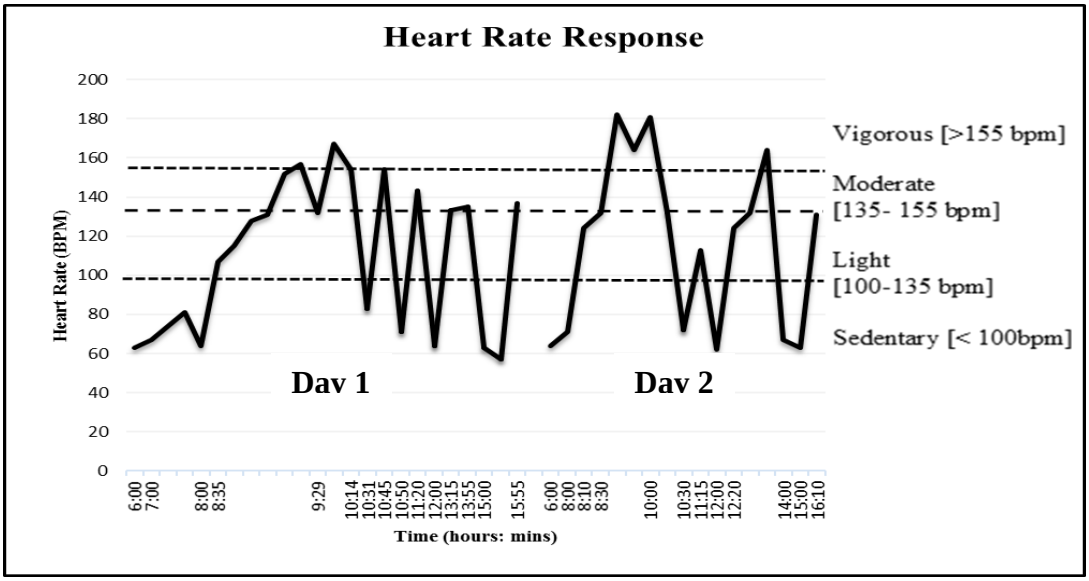
DAY 2	Time (hour)	Duration (min)	Intensity Avg. HR (bpm)	Description of PA
AM				
	6:00	120	64	Home; breakfast
	8:00	10	71	Driving to hunting areas/ opening gates/ spotting from truck
	8:10	20	124	Walk; gullies, hills, ravines, fields, forest
	8:30	16	132	Cleaning deer
	8:46	14	182	Dragging deer from forest
	9:00	60	164	Walking uneven terrain
	10:00	10	181	Walking uphill
	10:10	20	132	Walking
	10:30	45	72	Driving between hunting areas
	11:15	45	113	Walking forested areas
PM				
	12:00	20	62	Driving
	12:20	40	124	Walking forested area
	13:00	30	132	Walking flat fields
	13:30	30	164	Walking uneven terrain
	14:00	60	67	Break
	15:00	70	63	Drive home
	16:10	35	131	Cleaning/ skinning/ fixing/hanging meat

Min= minutes; Avg. HR = Average Heart Rate; bpm=beats per minute

HR<100	Sedentary	HR 100-135	Light	HR=135-155	Moderate	HR > 155	Vigorous

This research project received ethical approval through the University of British Columbia's Behaviour Research Ethics Board (#H17-00884) and was done in partial fulfilment of a senior level undergraduate course. The Esketemc First Nation Council were consulted on this project. Since the research was conducted by a single investigator, who was both subject and investigator, there was no requirement for formal agreement between the investigators and the Esketemc First Nation. Future investigations that include a larger sample group of Band members will require a formal Band Resolution of Agreement between Band council and the investigators.

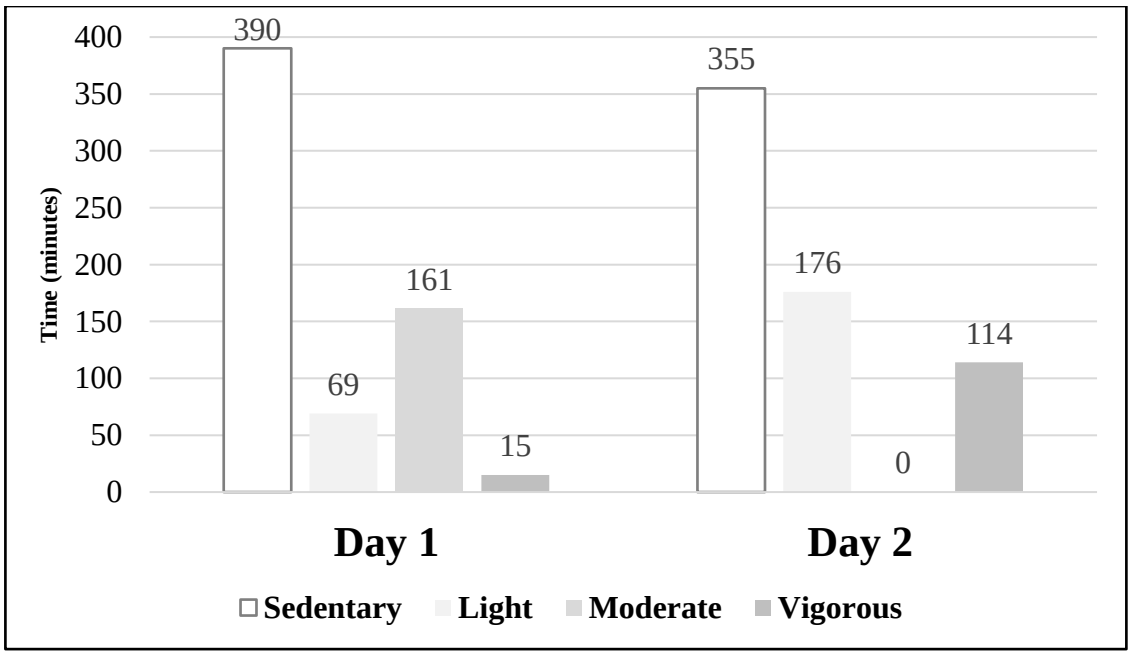
Figure 1. Heart rate response recorded across 2-days of hunting



Results

Over sixteen hours of heart rate recordings were captured during the 2-day hunt (*see* Figure 1). These values illustrate the variance of heart rate response that is attributable to the type of PA performed (sitting versus walking) and the terrain being covered (flat field versus climbing hills). The participant's heart rate response was more variable on day 1. Although the participant spent the majority of the day (6.5 hours) being relatively sedentary sitting in his truck (3 hours) and only being on foot for 22 minutes, before shooting his first deer (*see* Table 2). Nevertheless, the participant did accumulate 161 minutes of moderate intensity PA, enough to meet the CPAG recommendations required for one week (*see* Figure 2).

Figure 2. Accumulated time (minutes) across physical activity intensities



This moderate intensity PA was achieved by walking over uneven terrain, cleaning the deer, and dragging the deer a short distance to a spot accessible for transportation by truck. Day 2 illustrates a more physically challenging hunt with 114 minutes of PA performed at heart rates above 155 bpm, corresponding to vigorous intensity PA (*see* Figure 2). The increase in vigorous PA was attributed to dragging the second deer a greater distance and having to walk over more challenging terrain (uphill, forested area) for a longer period of time (*see* Table 3). The participant did not accumulate any PA within the moderate intensity zone on day 2 (*see* Figure 2), likely because of the greater amount of time spent doing more vigorous intensity PA. Walking over uneven terrain and moving the deer to an area accessible by truck provided the greatest health and fitness benefit. However, the majority (58%) of the 2-day hunt was performed at a sedentary intensity (<100 bpm); 19.5% was at a light intensity (100-135bpm); 12.5% at a moderate intensity (135-155); and 10% at a vigorous intensity for this individual (>155). These recordings provide an opportunity to understand the contribution of hunting activities towards achieving weekly PA requirements outlined in the CPAG.

Discussion

There are very few resources and facilities for isolated Indigenous communities to engage in meaningful PA, which will improve health and fitness. Providing experiential learning opportunities through traditional cultural practices may be an effective way of helping Indigenous youth to understand the contribution of daily PA to overall health and fitness. Living off the land provides an opportunity to offset sedentary behaviours with culturally rich PA (Young & Katzmarzyk. 2007). Currently, only 26% of Indigenous adults achieve the CPAG of 150 min/week (NCCAH, 2013), placing many at higher risk of chronic disease, disability, and early mortality (George et al., 2015; Tjepkema & Wilkins, 2011). Hunting alone is not the only method for improving Indigenous health; however, it does provide an innovative teaching paradigm to help Indigenous youth become more active and physically literate. Achieving levels of daily PA that engender health and fitness benefits through activities that have cultural and traditional relevance will have a positive effect on community health (Rollestone et al. 2017). Hunting for sustenance is a cost-effective and accessible activity, with deep cultural meaning for Indigenous people living in rural communities. On-foot, walking over uneven terrain, the hunter is required to work at a moderate to vigorous intensity. Cleaning and moving the deer carcass for transportation pick-up, requires an almost maximal effort by the hunter (Petersen et al., 1999). Verba, Jensen, and Lyn (2014), reported similar results, that walking over uneven terrain and moving the deer recorded high heart rate values in both men and women. Therefore, there are features of hunting that provide an opportunity for the individual to achieve health and fitness benefit because hunting requires physical work at a moderate to vigorous intensity. Hunting over several days will have likely provided an even greater health and fitness benefit. In this case study, the participant surpassed the minimum weekly PA standards, within a single day of hunting and almost doubled his PA on the second day. Accumulating more PA is dose-dependent, greater health and fitness benefits are achieved by doing more than the minimum values (150 min/week of moderate to vigorous PA) outlined in the CPAG (CSEP, 2011).

In today's modern society, all-terrain vehicles are widely used for hunting. Arguably, driving cross-country does not provide the same health and fitness benefits as stalking an animal on foot. This case study provides a snapshot of PA related to hunting deer relative to heart rate response by a single Indigenous male. The participant's self-reflected record of his personal PA facilitated his understanding of the contribution of PA to his personal health and fitness habits. For example, by time-locking his PA log with the heart rate monitor output allowed him to recognise that the majority of his accumulated hunting practices were considered low-intensity PA (sedentary), which provides little health benefit. However, there were portions of the hunt that did require physical exertion at intensities (heart rate response > 135 bpm) and of durations (> 30 min per day) that confer health and fitness benefit (i.e., walking over uneven terrain, cleaning and dragging deer). This opportunity provided this

individual with an experience to become more physically literate through focused understanding of the specific contribution of PA toward preserving and/or improving overall health and fitness, through the traditional practice of hunting for sustenance.

Hunting provides an innovative paradigm in which to explore PL. *Motivation* toward being more physically active, through hunting, is generated by both the need for food and/or the desire to hunt a large game animal (e.g., trophy buck) for honour and prestige. Being a successful hunter, providing food for family and the community, builds *confidence* through improved self-esteem and use of hunting knowledge. Knowing how to stalk, humanely kill through marksmanship, and clean the deer requires a high level of *skill competence*. Understanding the contribution of PA throughout the hunt, provides the user with greater *knowledge* of what type of PA is most beneficial to supporting health and improving fitness. *Understanding the value* of PA, acquired through traditional hunting practice, taught this individual about the importance of hunting more on-foot than from a vehicle. In addition, understanding the physical demands of hunting is important, as hunting often requires the individual to make a rapid transition from low-intensity PA to high-intensity PA. This might be of concern for those with underlying cardiovascular disease since some hunting related activities require maximal exertion (Petersen et al., 1999). Inclusion of other community members, specifically Elders, may help the younger hunter to acquire additional knowledge through experiential learning within the natural environment (Kirmayer, Simpson, & Cargon, 2003).

There are limitations with this investigation. A case study does not provide evidence to demonstrate that all Indigenous youth would receive health and fitness benefits from hunting. However, this case study does provide proof of concept, in that traditional hunting is feasibly a practical method to increase PL among Indigenous youth.

Conclusion

Hunting is an excellent PA for experiencing traditional culture while receiving health and fitness benefits, through physical exertion. Over the 2-day hunt, this Indigenous youth easily surpassed the recommended levels of daily PA. A substantial portion of the hunt required physical exertion of moderate to vigorous intensity, which confers both health and fitness benefit. However, the largest portion of time for the hunt required low levels of PA, indicative of sedentary behaviour. Through this enriched learning opportunity, this Indigenous youth was able to experience PL through understanding the motivation, confidence, skill competence, knowledge and understanding of the value of the contribution of different types of PA required for hunting. Walking more and driving less, would be an appropriate modification to improve the health and fitness acquired through deer hunting

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