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Hunting can increase physical activity of Indigenous peoples in Canada: pixem re yecwme'nstut

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Abstract

This study examined whether Indigenous peoples could achieve the Canadian Physical Activity Guidelines (CPAG) for adults while engaging in the cultural practice of hunting. It was hypothesized that Indigenous hunters would achieve or surpass the physical activity (PA) thresholds set forth by the CPAG on days spent hunting. Step count and heart rate were recorded from six male participants during mule deer hunts and days spent on-reserve. Step count was not statistically different between days spent hunting (28 803 ± 10 657 steps) and on-reserve (15 086 ± 7536 steps) ($p = 0.10$). Time spent in light (257 ± 45 min; $p = 0.04$), moderate (118 ± 71 min; $p = 0.03$), and vigorous (45 ± 42 min; $p = 0.04$) activities while hunting was greater than on-reserve (light, 180 ± 86; moderate, 71 ± 73; vigorous, 7 ± 10 min). The duration of moderate-to-vigorous PA (119 ± 95 min) for an average day hunting nearly meets the weekly CPAG recommendation of 150 min per week and is 1.8× greater than on-reserve (67 ± 80 min). Data suggest that hunting is probably a viable mode of PA for Indigenous adults to achieve health benefits. A strength of this study is the 10 h of daily recording which includes vehicular transportation to remote hunting areas. The duration of very light/sedentary PA did not differ between hunting (233 ± 211 min) and on-reserve (327 ± 164 min; $p = 0.10$), and highlights the importance of modernized vehicles in traditional Indigenous activities. A larger sample size would facilitate greater exploration of transportation, as well as success of the hunt on PA. These data suggest that health researchers and clinicians should consider traditional activities such as hunting as a means for Indigenous adults to increase participation in sufficiently vigorous PA to incur health benefits.

Key words: exercise, Canadian Physical Activity Guidelines, sedentary behavior, Aboriginal, Indian, land-based activities

Introduction

Physical activity (PA) is a cornerstone of human health, yet its potential to contribute to Indigenous health in Canada is not being fully realized. Researchers are calling for more research on promoting Indigenous PA, and in particular PA involving cultural practices (Pelletier et al. 2017; McHugh et al. 2019; Murdoch-Flowers et al. 2019). Traditional land-based activities (LBAs), such as fishing, berry picking, and hunting, have rich legacies in communities, and offer a range of social, psychological, nutritional, and physiological health benefits (Ahmed et al. 2021). A strength of LBAs is that they centre Indigenous peoples, knowledges, activities, and places in Indigenous health solutions. Yet, LBAs have been overlooked in the PA literature for emphasis on sport and exercise, which are usually formally organized and based on infrastructure available in urban centres (Tang et al. 2016; McHugh et al. 2019). Promoting LBAs to support PA engagement could concurrently support recovery of Indigenous cultural practices and improve Indigenous health outcomes.

PA research is needed because of the significant barriers Indigenous peoples in Canada endure, such as lack of infrastructure and transportation (Pelletier et al. 2020), and racist policies that have sought to eradicate Indigenous cultural PA practices (Forsyth 2007). Colonialism segregated Indigenous peoples to often less fertile reserve lands that were a fraction of the territorial lands that had supported their existence for thousands of years (The Chiefs of the Shuswap, Okanagan, and Couteau Tribes of British Columbia 1910). Today, Indigenous peoples living on-reserve hunt far less than their predecessors as access to their traditional hunting territory was greatly reduced, if not removed entirely.

Many individuals in Canada do not achieve the Canadian Physical Activity Guidelines (CPAG) recommended for 150 min of moderate-to-vigorous PA per week (Ross et al. 2020). The existing evidence points to low levels of Indigenous PA participation (Foulds et al. 2013), which elevates risk for certain diseases (Booth et al. 2012). Compared to the rest of Canada, Indigenous populations exhibit higher prevalence of

heart attack (5.0% vs. 3.9%), stroke (2.1% vs. 0.8%), and obesity (37.8% vs. 22.6%) (Katzmarzyk 2008; Hu et al. 2019), and the prevalence of diabetes among Indigenous youth is rising faster than the prevalence among youth from the general population (Oster et al. 2012). Foulds et al. (2013) conducted a review to find that few Indigenous peoples of North America meet activity recommendations, namely 27.2% of adult population and 26.5%–45.7% in youth (Foulds et al. 2013). Such claims, however, are the best conclusions drawn from a dearth of data on Indigenous PA (Foulds et al. 2013).

It remains to be determined how LBAs can be mapped onto the CPAG so that they can be considered as legitimate options for health promotion. Although a robust understanding of LBAs ought to be holistic, specific scientific studies play a role in effective promotion and knowledge about the physiological effects of these activities. If health promotion experts and the scientific literature lacks knowledge about Indigenous cultures and LBAs, these activities will continue to be overlooked as options for health promotion to the ongoing detriment of Indigenous communities. This study seeks to provide evidence about the potential physiological impacts of mule deer hunting and the ability of deer hunting to map onto existing frameworks for assessing and promoting PA. One small pilot study revealed that hunting on-the-land and within the territory could provide members of rural reserve communities sufficient PA engagement to promote health (Paul et al. 2019). This observation informed our hypothesis that hunting wild game would allow participants to achieve PA intensities that, if done regularly, would engender both health and fitness benefits for the participants. Ultimately, this would support Indigenous practices to be acknowledged and supported in promoting Indigenous wellbeing.

Materials and methods

The study was designed to observe PA during hunting and to compare these activities to the CPAG and on-reserve lifestyle activities. The study was approved by the Chief of the Esk'etemc Indian Band and hunters from the community were identified by community leadership. The community is in the mid-interior region of British Columbia (BC), rural and separate from towns or cities, which is typical of Indigenous communities in the mid-interior and in northern BC. The lead investigator (SP) distributed information about the study to these hunters and obtained informed consent to participate from each volunteer. There are approximately 20 total mule deer hunters in this community, most of whom are men. Although women were recruited, none volunteered to participate. All participants were physically independent and self-reported to be in good health. None were taking medications for underlying health conditions. All participants had >13 years of hunting experience, lived on- and off-reserve ($n = 1$) and were knowledgeable about hunting safety and cultural protocols. The study was approved by the University Behavioural Research Ethics Board (H18-02651).

Relationship

Researchers who aspire to support community-based health research with Indigenous peoples must not discount the importance of building relationships with community members and their leaders to facilitate understanding among stakeholders. Navigating these relations is a finite balance between typical academic research and growing awareness of community-led and facilitated research where within the ultimate aim is to inform the communities wishes, needs, and expectations. The lead investigator (SP) is a member of the Esk'etemc Indian Band and resides in the local community in which the study took place. His personal connection to Community, Chief, and Council facilitated their partnership with the University and ensured key points of interest were mutually understood. For example, it was vitally important to the community that traditional knowledge of hunting areas would remain confidential. Thus, before data collection began, it was agreed upon by the Chief and research team that the geographic locations of hunting areas would not be made known to members of the research team, with the exception of SP, and that geographic tracking data would not be recorded.

Experimental setup and protocol

PA during hunting was compared against PA from activities of daily living performed on-reserve. Participants recorded heart rate (HR) at 100 Hz (beats per minute, BPM) and step counts on two hunting days and two days spent on-reserve that were representative of their typical routines. Participants were instructed in-person on how to properly manage and position the wGT3X-BT accelerometer (ActiGraph, Pensacola, FL) and Polar H7 HR monitor (Electro Oy, Kempele, Finland) the day before their first day of data collection. Accelerometers were placed over the dominant hip to monitor ambulatory movement and sampling rate was set to 100 Hz. HR monitor electrodes were dampened during setup to enhance signal acquisition. Baseline participant characteristics of body weight, height, body mass index, age, and resting HR (HRrest) in BPM were recorded during the setup session. HRrest was acquired by taking the radial pulse after 5 min of quiet sitting. The accelerometers were set to begin recording movement and HR data 1 h before the participants' self-reported expected wake up time.

The order of daily recordings depended upon each participant's hunting schedule. The recommendation was for the four recordings to occur within a 2-week period. This was not always feasible due to weather and personal commitments off-reserve; however, all recording happened in the same season (Fall). Recording start times were selected according to each participant's personal preference. For example, if a participant intended to leave for a hunting excursion at 7:00am, the devices started recording at 6:00am. For on-reserve days, recording began at their expected wake-up time. Stop time was left open and PA was continuously recorded until manually stopped by the participant. Participants also logged PA in paper journals, which were used to verify PA performed throughout the day. The accelerometer recordings for movement were cross-referenced with journal entries to verify PA recordings and ensure that motor vehicle commuting was appropriately coded, and that onset time was properly initiated.

Data analysis

A general age-estimated formula of 220 BPM minus age in years was used to determine each participant's theoretical maximum HR (HRmax). HR reserve (HRR) was defined as the difference between HRmax and HRrest. PA time was binned into four ranges of intensity (%HRR): very light <20%, light 20%–40%, moderate 40%–60%, and vigorous > 60%.

Accelerometer data were downloaded to the ActiLife 6™ software for preliminary analysis of step counts and HR using the Freedson algorithm which is embedded within the software and appropriate for use with male groups aged 19–60 years who perform ground-based physical activity. The recordings were assessed for outliers and missing data. Recordings were excluded when there was <3 h of movement recorded throughout the day, or >60 consecutive minutes of HR recordings were missing. Mean total recording time was greater on hunting (626 min) than on-reserve days (588 min). To account for large periods of additional sedentary time accumulated on hunting days, the middle 5 h of each sampling period were also examined. Three participants were unable to record a second hunting day because they were either injured, attending to a personal issue, or had a faulty recording. One on-reserve day was lost during data transfer for analysis.

Statistical analyses were performed with the IBM Statistical Package for the Social Sciences (SPSS 26.0, Chicago, IL). Significance was defined as $p < 0.05$. Data were reported as means ± standard deviations. Data were compared both within and between the hunting and on-reserve days. The within day PA data did not differ (hunting, $p = 0.19$; on- reserve, $p = 0.09$), and thus averages across the two hunting days and the two on-reserve days were used in between-day comparisons. Paired sample *t* tests were used to compare HR, step counts, and PA levels between hunting and on-reserve days.

Results

Six Indigenous males (36 ± 11 years, 174.8 ± 6.5 cm, 86.4 ± 8.9 kg, 28.2 ± 2 kg/m^2) of the Esk'etemc Indian Band volunteered to participate in the study. All participants were registered under the Indian Act. Participants' HRrest (62.8 ± 5.7 BPM), age-predicted HRmax (182.7 ± 10.8 BPM), and HRR (119.8 ± 11.2 BPM) were within the expected ranges. The average step count was not significantly different on hunting days (28 803 ± 10 657 steps) compared to on-reserve days (15 086 ± 7536 steps) ($p = 0.10$). Mean HR was not significantly different between hunting (95 ± 12 BPM) and on-reserve days (89 ± 15 BPM) ($p = 0.18$) (Table 1). The duration of very light physical activity did not differ between days spent hunting (233 ± 211 min) and on-reserve (327 ± 164 min; $p = 0.10$). Light (257 ± 45 min; $p = 0.04$), moderate (118 ± 71 min; $p = 0.03$), and vigorous (45 ± 42 min; $p = 0.04$) activities were greater for time spent hunting than on-reserve (light, 180 ± 86; moderate, 71 ± 73; vigorous, 7 ± 10 min) (Fig. 1). The duration of moderate plus vigorous PA for hunting and on-reserve days exceeded the CPAG recommended 30 min per day (Fig. 1); however, hunting (162 ± 91 min) was 2 × greater than on-reserve (78 ± 77; $p = 0.02$). When the middle 5 h of data were analyzed, mean HR was not significantly different between hunting (99 ± 15 BPM) and on-reserve days (91 ± 18 BPM) ($p = 0.21$). Duration of activities within the very light, light, moderate, and vigorous intensity zones did not differ (Fig. 1), but moderate plus vigorous was significantly higher in the middle 5 h of the day for hunting (100 ± 71) compared with on-reserve (49 ± 51 min). Step count was not significantly different between hunting days (12 839 ± 4234 steps) compared to on-reserve days (7471 ± 3303 steps) ($p = 0.12$).

Table 1. Daily heart rate values (beats per minute averaged over entire day).

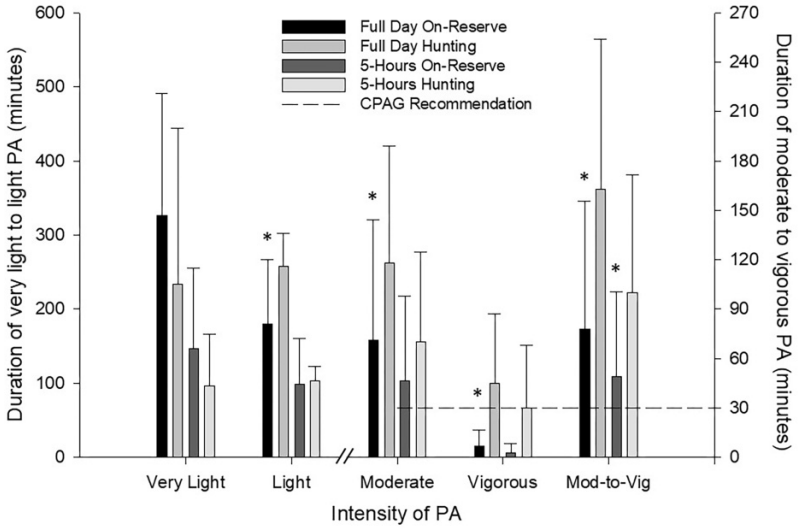
Participant	Hunting	On-reserve
1	112	91
2	101	101
3	93	110
4	83	77
5	81	67
6	99	89
Mean (standard deviation)	95 (12)	89 (15)

Discussion

This investigation quantified the PA behaviours of Indigenous males on days they hunted mule deer compared to days living on-reserve. It was hypothesized that the PA demands of this LBA would exceed the daily PA demands of living on-reserve, as well as the daily PA thresholds required to maintain overall health. Statistical significance was not achieved in HR, or step count. The duration of time spent in light, moderate, and vigorous activity was greater hunting than on-reserve. Findings indicate that the Indigenous hunters (30% of eligible population) gain cardiovascular and health benefits from hunting. On days spent hunting, the duration of light to vigorous intensity PA was approximately double the days spent on-reserve (Fig. 1) and exceeded the CPAG guidelines of 30 min per day (Ross et al. 2020). This suggests that Indigenous hunters from the Esk'etemc Indian Band likely incur health benefits by engaging in present day hunting methods informed by traditional LBAs.

Earlier reports discuss hunting as a means of reconnecting Indigenous peoples with the land to rekindle their understanding of the health and wellness benefits associated with the symbiotic interaction between the land and its inhabitants (King and Furgal 2014). Allen et al. (2020) reported that outdoor PA improves the overall happiness and wellbeing of Indigenous peoples (Allen et al. 2020). Skinner and colleagues (2013) recognized hunting as an important outlet for Indigenous communities to address food insecurity, especially in remote regions (Skinner et al. 2013). Until now, no study has examined the quantity and intensity of PA required to actively participate in such traditional activities. This study demonstrated that Indigenous males can potentially surpass the health and fitness recommendations proposed within the CPAG when hunting mule deer, and that they can maintain and/or improve health and fitness through

Fig. 1. Duration (means ± standard deviations) of sedentary activity (left axis) and low-to-vigorous physical activity (PA) (right axis) on days spent hunting and living on-reserve. The analysis was conducted on full data sets (full-day on-reserve/hunting) as well as data from the middle 5 h of each day (5 h on-reserve/hunting). Dashed line identifies the daily PA requirements (30 min/day) set forth by the Canadian Physical Activity Guidelines (CPAG) for adults 18–64 years (Ross et al. 2020). *, significant difference between hunting and on- reserve ($p > 0.05$). Mod-to-vig: moderate-to-vigorous PA.



regular engagement in traditional types of PA, such as deer hunting. Leaving the reserve for urban centres creates behaviours unique from on-reserve activities. On non-hunting days movement and steps varied substantially between participants, because jobs and activities vary between individuals. Some participants had higher PA because their jobs were more physical in nature (e.g., forestry/logging relative to desk-based work) and others travelled to nearby towns. Overall, the daily PA achieved on-reserve was largely influenced by employment and commuting to urban centres. Those in labor jobs achieved recommended PA while those travelling to town or working non-labor jobs did not achieve PA levels sufficient to achieve health and fitness benefits on-reserve. Overall, the moderate–vigorous time for hunting (~163 min) was 2.1 greater than on-reserve (77 min). Although PA can be gained on-reserve this is achieved in physical labor jobs. Regularly engaging in LBAs that also incur health and fitness benefits could address issues of both health and culture related to the imposition of colonialism (Barron 1988; Leeuw et al. 2012), and ameliorate health inequities experienced by Indigenous peoples living and working on-reserve (Murdoch-Flowers et al. 2019). Therefore, health and fitness guidelines for Indigenous peoples living on-reserve should include traditional LBAs as a means to encourage participation in regular PA and facilitate achievement of CPAG recommendations.

Reviewing participants' PA log books revealed that some participants spent long periods of time being sedentary as they drove to and from hunting sites. Living on a reserve unfortunately limits access to traditional territory, and local hunters must often use motor vehicles to find hunting sites that are likely to be successful. The countryside is vast in terrain for these Indigenous hunters and has plenty of hills, ravines, steep embankments, and fields that require extensive walking/hiking throughout the day. Yet, to access these rural and remote areas requires sedentary driving activity and likely influences the step count achieved over the course of hunting. Since hunting is a means for rural and remote Indigenous communities to ensure food security, it is unreasonable to suggest that modern conveniences not be used during hunting excursions. Although modernization has altered some aspects of hunting through transportation, and in some instances scoped rifles, the behaviours that surround the habits of the animal remain the same, and thus aspects such as geographical area, tracking deer, lifting, and skinning deer remain unchanged from the experience of this community's ancestors. These aspects of traditional hunting foster PA and contribute to the health benefit associated with hunting.

Health researchers should consider aspects of individual preferences in the practice of hunting (i.e., choice of terrain, modern tools, or game), as well as success of the hunt, when seeking to determine the influence of hunting on daily PA. An individual carrying a deer will undergo heightened levels of exertion than walking without carrying a load. Mule deer from this region weigh approximately 73 kg during the time of hunting and data collection (October–November) and personal winter gear and equipment weigh an additional 5–10 kg during this season. Thus, the load carried on a successful hunting day would likely exceed 75 kg. This is a substantive weight to induce increased exertion and levels of PA to induce positive health benefits. The intensity of hunting is further evident as the number of steps recorded did not differ between hunting and on-reserve. Overall, hunting increases the intensity of PA and a successful hunt markedly increased PA because the hunter was required to immediately track the

fatally injured deer, then field dress and drag or carry the deer to their truck over uneven terrain. Later in the day, hunters also must skin the deer and butcher the meat and during these activities' moderate intensity of activity was typically achieved and accounts for the non-significant differences observed in the middle 5 h period. Thus, a successful hunt requires substantially more work by the hunter (Verba et al. 2014; Paul et al. 2019) throughout the day which indicates that the result of the hunt might be a consideration in determining whether a hunt is a sufficient means of achieving health and fitness benefits through PA.

Limitations

The institutional research requirements for participant-informed consent, use of movement tracking technology, and formal documentation processes invoked apprehension among community members due to historical misrepresentations of research studies imposed upon Indigenous groups (Smylie and Anderson 2006). As a result, many potential volunteers declined to participate. Barriers to recruitment persisted despite the support of Chief and Council, and the primary student investigator being a member of this community. Without his personal affiliation with community leadership, this research project would have taken much longer to implement and potentially been impossible to undertake. Despite challenges to achieving a robust number of participants, approximately 30% of the Esk'etemc community's mule deer hunters volunteered to participate and thus, a representative sample of this particular community was studied. Prior to initiating research partnerships with any Indigenous community, it is important that participants understand that the research is being conducted with and for them, rather than on them (LaVeaux and Christopher 2009). Researchers who aspire to support community-based health research with Indigenous organizations must not discount the importance of building relationships with community members and their leaders to facilitate understanding among stakeholders.

Conclusion

The results of this study demonstrate that engaging in the practice of hunting could increase the quantity and intensity of daily PA accumulated by Indigenous adults. Although, the sample size was small, the results may be broadly applied to other Indigenous hunters located in similarly rural and remote areas of Canada. There is potential to gain health and fitness benefits by engaging in the practice of hunting.

Community involvement

This investigation took place on the ancestral and unceded territorial lands of the Esk'etemc First Nation with permission and cooperation from the Esk'etemc Chief and Council. All participants were recruited from the Esk'etemc community.

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Data availability

Data are available from the corresponding author upon reasonable request.

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Author notes

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Author contributions

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Formal analysis: SP, JJ
Funding acquisition: JJ
Methodology: SP, JJ
Project administration: JJ
Resources: FR
Software: JJ
Supervision: KR, BTH, JJ
Validation: EH, JJ
Writing – original draft: SP
Writing – review & editing: SP, EH, KR, BTH, JJ

Competing interests

The authors declare no competing financial interests. Authors SP and FR are members of the First Nation community in which the project took place, and maintain a personal interest in said community's health.

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