



Short Communication

Psycho-physical demands of Traditional Indigenous Games played by Aboriginal and Torres Strait Islander women

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ABSTRACT

This study examined the psycho-physical demands experienced by Aboriginal and Torres Strait Islander women during several Traditional Indigenous Games (TIGs). Women engaged in three TIGs (Kai Wed, Ilye, Edor) with psycho-physical demands (i.e. heart rate; movement distance and speed; rating of perceived exertion, RPE) recorded. Significant differences were noted between TIGs with Ilye inducing greater maximum and average heart rate (5–14 %), absolute and relative distances (146–282 %), speed (3–29 %) and lower RPE (48 %) compared to Kai wed and/or Edor. Results will guide future, culturally relevant interventions to improve physical activity levels and health outcomes for Aboriginal and Torres Strait Islander women.

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Practical implications

- Aboriginal and Torres Strait Islander women experience unique psycho-physical demands during different TIGs.
- Familiar TIGs induce moderate–high levels of psycho-physical stress recommended to improve cardiovascular health.
- The inclusion of activities with cultural significance (TIGs) into PA regimes may contribute to greater compliance for Aboriginal and Torres Strait Islander women.
- Exercise practitioners are encouraged to prescribe TIGs and support Aboriginal and Torres Strait Islander women's physical, cultural and health needs.

1. Introduction

In Australia, Aboriginal and Torres Strait Islander women have a 10-year lower life expectancy when compared to non-Indigenous women.¹ This disparity was reported to result from the high prevalence of cardiovascular disease risk factors including physical inactivity² as well as

intergenerational trauma related to colonisation.³ To address this racial inequality and improve Aboriginal and Torres Strait Islander health, several studies have implemented structured programmes with varying results and participatory rates.^{4–6} For example, a 12-week group-based sports and gym exercise session improved metabolic, anthropometric, and fitness variables, as well as increased participation by Aboriginal and Torres Strait Islander men.⁴ In contrast, a combined exercise and nutrition workshop intervention resulted in modest reductions in body mass, blood pressure and body mass index, but low attendance rates and limited engagement by Aboriginal and Torres Strait Islander women.⁶ To address low participation rates with First Nations people, especially women,^{6,7} studies have incorporated cultural norms and values to significantly influence positive health outcomes.⁸ Whilst prior studies have highlighted the positive effects of exercise or physical activity (PA) with cultural integration, they have been limited to studies of Aboriginal and Torres Strait Islander men.^{4,5} Previously,⁹ we reported that racism and shame were unique barriers for Aboriginal and Torres Strait Islander women to undertake PA with fun, culture, and involvement with other First Nations people being important facilitators. Before Australia was colonised, Indigenous communities played Traditional Indigenous Games (TIGs) for enjoyment, but also to enhance physical fitness components, essential for survival.^{10,11} The games also provided an opportunity to learn, appreciate, and experience different aspects of Aboriginal and Torres Strait Islander culture, as well as provide an opportunity to improve social interaction.^{10,11} Whilst TIGs were mainstream PA for past generations,^{11,12} recently Aboriginal and Torres Strait Islander women expressed concerns about the intensity

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of some TIGs⁹ that may be a limiting factor for future use in PA programmes. The aim of this study was to determine the psychological/mental (e.g. self-rating of exertion/effort) and physical (e.g. heart rate, HR) demands (i.e. psycho-physical demands) of three common TIGs for Aboriginal and Torres Strait Islander women.

2. Methods

2.1. Participants

Thirteen Aboriginal and Torres Strait Islander women (age 31.5 ± 8.7 years; height 164.8 ± 4.8 cm; mass 81.1 ± 15.0 kg) from local community groups living in North Queensland Australia were invited to participate in this study. All women met the following inclusion criteria: 1) not pregnant; 2) exhibiting one or more cardiovascular risk factors (e.g., smoking, alcohol consumption, high body mass, physically inactive, high blood pressure); and 3) aged between 18 and 70 years. Local institutional Human Research Ethics Committee approval (H8490) was obtained and participants provided written, informed consent prior to participation.

2.2. Study design and materials

This study was part of a larger study⁹ and followed best practice research with Aboriginal and Torres Strait Islander participants¹³ including consultation with the community and inclusion of a cultural mentor and local Aboriginal woman to support the primary researcher, an Aboriginal woman (Gamilaraay and Kuku Yalanji). As described previously,⁹ six TIGs (i.e. Buroinjin, Edor, Ilye, Arrkene Irreme, Noongar Wana, Kai Wed) from a national resource of Australia and/or Torres Strait Indigenous games,^{11,12} were selected by the primary researcher for consideration based upon their appropriateness for women to play, and their physical demands, determined via a desktop needs analysis.¹⁴ Each game was categorised via the needs-analysis as low- (50–60 % maximum HR), moderate- (70–80 % maximum HR) or high-intensity (80–90 % maximum HR) to reflect the likely physical requirements for each TIG as part of the larger study.⁹ Without knowing the intensity of the TIGs, participants selected one low-intensity (Kai Wed; origin = Torres Strait), one moderate-intensity (Ilye; origin = Central Australia), and one high-intensity game (Edor; origin = Far North Queensland) to complete within the current study. Kai Wed was a ball game that was similar to volleyball where the ball was kept in the air for as long as possible. Ilye was a running game of two teams where teammates threw a frisbee (instead of a boomerang) to each other to score a goal at the opposite end of the field (and avoid it being intercepted or dropped). Edor was a chasing/tagging game where teammates ran to the other end of the field without getting touched/tagged by the opposite team.¹²

2.3. Procedure

Before commencing the TIG session, each participant was pre-screened using a standardised medical questionnaire (e.g. physical activity level) and physical assessments (e.g. height, mass, waist circumference and resting systolic/diastolic blood pressure).¹⁵ Following pre-screening, participants completed a standardised, dynamic warm-up (e.g. high knees, back kicks, lunges, squats, light jog) for 5 min and then participated in all three TIGs within the same session (~90 min). The session commenced at 09:00 with each TIG separated by 5–10 min of passive recovery, as determined by the participants' readiness through verbal communication and time to complete the post-game feedback including: (1) their rating of perceived exertion/effort (RPE)¹⁶; (2) what they liked about the TIG; (3) what they did not like about the TIG; and (4) whether they would play this TIG again, and why. At the end of the session, participants completed a standardised five-minute warm down of static stretching.

2.4. Data analysis

The physical demands of the TIGs were recorded by a telemetric system (POLAR TEAM PRO, Polar Electro, Kempele, Finland) that included HR monitor, accelerometer, gyroscope and global positioning sensors to record data at 200 Hz (Polar Team Pro, 2019). The system was reported to be valid and reliable for the recording of HR¹⁷ and speed and distance in an outdoor environment.¹⁸ The following psycho-physical demands were examined for each TIG: 1) RPE; 2) average and maximum HR; 3) the time spent within pre-determined, age-predicted, HR zones; 4) total distance covered; and 5) peak and average speed experienced. Comparisons of psycho-physical demands between all TIGs were conducted using Friedman's tests and post-hoc Durbin–Conover pairwise comparisons. The post-game feedback was collated and thematically analysed (i.e. familiarisation, coding, generation, review, defining/naming, and writing).¹⁹

3. Results

Participants experienced significantly different maximum HR during the TIGs with the greatest being achieved during Ilye and the lowest during Kai Wed (Table 1). The average HR was significantly greater during Ilye compared to Kai Wed and Edor (Table 1). Participants reported a significantly lower RPE after playing Kai Wed when compared to both Ilye and Edor (Table 1).

Participants covered significantly different distances during the TIGs with the greatest being achieved during Ilye and the least during Kai Wed (Table 1). Similar findings were noted for maximum and average speed of movements with participants experiencing the greatest speed during Ilye and the lowest during Kai Wed. No significant difference was noted between Kai Wed and Edor for maximum speed despite significantly different average speeds (Table 1).

During Kai Wed and Ilye, participants spent the majority of the TIGs within the lower HR intensity zones with these times significantly higher compared to Edor (Fig. 1). Further, participants spent more time within the higher intensity zones during Ilye compared to Kai Wed and Edor (Fig. 1).

After completion of the TIGs, several common themes emerged for what participants liked about the TIGs. Women liked that each TIG involved teamwork, was fun, consisted of communication between each other, had variable intensity levels (light and/or hard), was engaging, and involved strategy and skill. The women mentioned that their poor physical coordination, past physical injuries, confusing TIG rules, and high intensity of some TIGs were aspects that they didn't like. Some women highlighted that Edor was a difficult game to understand as

Table 1

The psycho-physical demands of each Traditional Indigenous Game played by Aboriginal and Torres Strait Islander women.

	Kai Wed	Ilye	Edor
Heart rate			
Maximum – absolute (bpm)	153.2 ± 13.5	175.1 ± 20.4*	163.1 ± 29.4*†
Maximum – relative (% maximum)	77.3 ± 6.5	88.4 ± 10.3*	82.3 ± 14.8*†
Average – absolute (bpm)	127.1 ± 13.5	141.5 ± 19.0*	134.2 ± 24.8†
Average – relative (% maximum)	64.4 ± 6.7	71.6 ± 9.6*	67.9 ± 12.5†
Total distance covered			
Absolute (m)	151 ± 41	578 ± 195*	235 ± 116*†
Relative/intensity (m · min ⁻¹)	8.8 ± 2.4	29.0 ± 9.7*	19.7 ± 9.5*†
Speed of movements			
Maximum (km · h ⁻¹)	9.1 ± 2.3	11.7 ± 3.0*	11.4 ± 5.0
Average (km · h ⁻¹)	0.6 ± 0.2	1.9 ± 0.7*	1.3 ± 0.6*†
Rating of perceived exertion	3.1 ± 1.3	4.6 ± 1.6*	4.7 ± 1.6*

Values are mean ± SD; bpm – beats per minute; m – metre; min – minute; km – kilometre; h – hour.

* p < 0.05 vs. Kai Wed.

† p < 0.05 vs. Ilye.

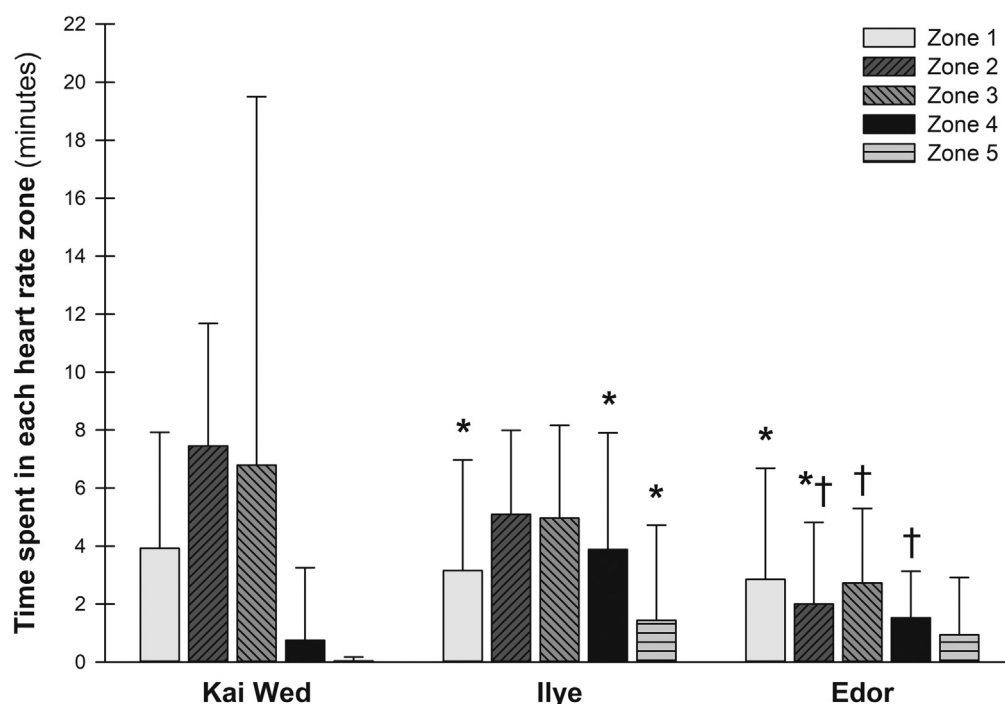


Fig. 1. Time spent in each heart rate zone during each Traditional Indigenous Game.

* $p < 0.05$ vs. Kai Wed; † $p < 0.05$ vs. Ilye.

they could not keep track of who was in. However, participants who were familiar with Edor reported positive feelings towards the game and feelings of nostalgia. The majority of women reported that they wanted to play each TIG again.

4. Discussion

The current study identified the unique psycho-physical demands of each TIG with distinct activity profiles (i.e. HR and speeds/distances for each game) that induced at least a moderate degree of psycho-physical stress. Teamwork, enjoyment, and variable intensity levels of activity were likeable aspects for TIGs whilst coordination, injury history, rules, and high-intensity levels of some TIGs were aspects that deterred women from engaging. Importantly, most women reported that they wanted to play each TIG due to positive experiences.

During the TIG review process,⁹ women chose games that they were familiar with and most likely based on their physical ability and presumed low fitness levels (as 92 % were not undertaking regular physical activity from pre-screening self-reports).¹⁵ Through a desktop needs analysis, Kai Wed was estimated to be a low-intensity activity however, Aboriginal and Torres Strait Islander women experienced moderate-intensity demands. Despite these higher-than-expected demands, Kai Wed was considered to be a fun activity that required teamwork and allowed the participants to build their confidence to participate in other TIGs. Importantly, the intensity levels experienced during Kai Wed were akin to those recommended to maintain and/or improve aerobic fitness and cardiovascular health.²⁰ Similarly, Ilye and Edor resulted in moderate-intensity demands with both TIGs representing PA intensities that exercise practitioners could prescribe to improve aerobic fitness and cardiovascular health.²⁰ Ilye required great amounts of running, agility, and coordination, due to the specific attacking and defending demands and resembled ultimate frisbee, a modern-day game mimicking cultural use of boomerangs by Aboriginal and Torres Strait Islander people. Interestingly, Edor was originally classified as a high-intensity PA via our desktop audit⁹ however, women experienced moderate-intensity demands. This lower activity level may have resulted from less engagement due to unfamiliarity with the TIG and/or

its confusing rules. Subsequently, familiarisation sessions for TIGs may be essential to introduce, or remind, Aboriginal and Torres Strait Islander women to specific TIGs and enable them to engage fully for physiological benefits.

Regardless of the TIGs undertaken, participants experienced positive emotions during the TIGs with the unique integration of culture with PA likely crucial to increase participants' future engagement and level of PA.²¹ Several studies have reported the important benefits of First Nation people engaging in cultural activities that also provide a form of PA.^{8,22} The current study provided further support with TIGs resulting in the completion of moderate-intensity activities at a level recommended for health benefits.²³ Regular engagement with TIGs could produce significant cultural and long-term health benefits for Aboriginal and Torres Strait Islander women (e.g. reduction of cardiovascular disease risk factors²⁴) that remain to be examined in future studies.

5. Conclusion

The current study identified that Aboriginal and Torres Strait Islander women liked engaging with each TIG that induced unique, psycho-physical demands (e.g. HR, speeds/distances, RPE). All TIGs resulted in participants experiencing at least moderate-intensity activity, a level recommended for health benefits. Future implementation of TIGs as a cultural PA programme may enhance engagement in PA and improve cardiovascular and overall health benefits for Aboriginal and Torres Strait Islander women.

Confirmation of ethical compliance

All participants provided written, informed consent prior to participation in accordance with the local institutional Human Research Ethics Committee approval (James Cook University, H8490) and Indigenous ethics advisor.

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Declaration of interest statement

The authors have no conflicts to declare.

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References

- Isaacs J. The health and welfare of Australia's Aboriginal and Torres Strait Islander peoples, 2003 — summary. *Aborig Isl Health Work* 2003;27(5):29–32. doi:10.3316/ielapa.167342122083059.
- Vos T, Barker B, Begg S et al. Burden of disease and injury in Aboriginal and Torres Strait Islander Peoples: the Indigenous health gap. *Int J Epidemiol* 2009;38(2):470–477. doi:10.1093/ije/dyn240.
- Pink B, Allbon P. *The Health and Welfare of Aboriginal and Torres Strait Islander People*. Canberra, AIHW, 2008.
- Mendham AE, Duffield R, Marino F et al. A 12-week sports-based exercise programme for inactive Indigenous Australian men improved clinical risk factors associated with type 2 diabetes mellitus. *J Sci Med Sport* 2014;18(4):438–443. doi:10.1016/j.jsams.2014.06.013.
- Sampson JA, Venables S, Debeneditics T et al. A pilot study using a small-sided games program to modify cardiovascular health in sedentary Indigenous men. *Health Promot J Austr* 2020;32(S2):72–77. doi:10.1002/hpja.409.
- Canuto K, Cargo M, Li M et al. Pragmatic randomised trial of a 12-week exercise and nutrition program for Aboriginal and Torres Strait Islander women: clinical results immediate post and 3 months follow-up. *BMC Public Health* 2012;12(1):933. doi:10.1186/1471-2458-12-933.
- Canuto K, Spagnoletti B, McDermott RA et al. Factors influencing attendance in a structured physical activity program for Aboriginal and Torres Strait Islander women in an urban setting: a mixed methods process evaluation. *Int J Equity Health* 2013;12(1):11. doi:10.1186/1475-9276-12-11.
- Kaholokula JK, Look M, Mabellos T et al. Cultural dance program improves hypertension management for native Hawaiians and Pacific Islanders: a pilot randomized trial. *J Racial Ethn Health Disparities* 2017;4(1):35–46. doi:10.1007/s40615-015-0198-4.
- Thorne T, Taylor S, Canuto K et al. Identifying barriers and facilitators to physical activity and perceptions of Traditional Indigenous Games among Aboriginal and Torres Strait Islander women: a qualitative study. *Health Promot Int* 2024;39(4). doi:10.1093/heapro/daae108.
- Sebastian T, Georgakis S, Nauright J. Traditional Aboriginal and Torres Strait Islander games and sports in Australia: new perspectives. *Sport Soc* 2024;27(2):207–227. doi:10.1080/17430437.2023.2232311.
- Edwards K. Traditional games of a timeless land: play cultures in Aboriginal and Torres Strait Islander communities. *Aust Aborig Stud* 2009;2:32–43. doi:10.3316/informit.650558226312950.
- Edwards K, Meston T. Yulunga: traditional indigenous games. https://www.sportaus.gov.au/__data/assets/pdf_file/0006/705462/Yulunga_Games.pdf.
- National Health and Medical Research Council, Australian Research Council, Universities Australia. *National Statement on Ethical Conduct in Human Research 2007 (Updated 2018)*. Canberra, Commonwealth of Australia, 2007.
- Hughes M, Franks I. *The Essentials of Performance Analysis, 1st ed.*, London, England, Routledge, 2008.
- Exercise & Sports Science Australia. Adult Pre-Exercise Screening System (APSS) tool. https://www.essa.org.au/Public/ABOUT_ESSA/Pre-Exercise_Screening_Systems.aspx 2021.
- Borg GA. Psychophysical bases of perceived exertion. *Med Sci Sports Exerc* 1982;14(5):377–381. doi:10.1249/00005768-198205000-00012.
- Gillinov S, Etiwy M, Wang R et al. Variable accuracy of wearable heart rate monitors during aerobic exercise. *Med Sci Sports Exerc* 2017;49(8):1697–1703. doi:10.1249/mss.0000000000001284.
- Cummins C, Orr R, O'Connor H et al. Global Positioning Systems (GPS) and micro-technology sensors in team sports: a systematic review. *Sports Med* 2013;43(10):1025–1042. doi:10.1007/s40279-013-0069-2.
- Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol* 2006;3(2):77–101. doi:10.1191/1478088706qp0630a.
- Garber CE, Blissmer B, Deschenes MR et al. American College of Sports Medicine position stand. Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults: guidance for prescribing exercise. *Med Sci Sports Exerc* 2011;43(7):1334–1359. doi:10.1249/MSS.0b013e318213febf.
- Nelson A, Abbott R, Macdonald D. Indigenous Australians and physical activity: using a social-ecological model to review the literature. *Health Educ Res* 2010;25(3):498–509. doi:10.1093/her/cyq025.
- Ironside A, Ferguson LJ, Katapally TR et al. Cultural connectedness as a determinant of physical activity among Indigenous adults in Saskatchewan. *Appl Physiol Nutr Metab* 2020;45(9):937–947. doi:10.1139/apnm-2019-0793.
- Powell KE, Paluch AE, Blair SN. Physical activity for health: what kind? How much? How intense? On top of what? *Annu Rev Public Health* 2011;32(1):349–365. doi:10.1146/annurev-publhealth-031210-101151.
- Mora S, Cook N, Buring JE et al. Physical activity and reduced risk of cardiovascular events: potential mediating mechanisms. *Circulation* 2007;116(19):2110–2118. doi:10.1161/circulationaha.107.729939.