Exercise intervention in New Zealand Polynesian peoples with type 2 diabetes: Cultural considerations and clinical trial recommendations

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REVIEW

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Abstract

The Maori and Pacific Islands peoples of New Zealand suffer a greater burden of type 2 diabetes mellitus (T2DM) and associated comorbidities than their European counterparts. Empirical evidence supports the clinical application of aerobic and resistance training for effective diabetes management and potential remission, but few studies have investigated the effectiveness of these interventions in specific ethnic cohorts. We recently conducted the first trial to investigate the effect of prescribed exercise training in Polynesian people with T2DM. This article presents the cultural considerations undertaken to successfully implement the study. The research procedures were accepted and approved by cultural liaisons and potential participants. The approved methodology involved a trial evaluating and comparing the effects of two, 16-week exercise regimens (i.e. aerobic training and resistance training) on glycosylated haemoglobin (HbA1c), related diabetes markers (i.e. insulin resistance, blood lipids, relevant cytokines and anthropometric and hemodynamic indices) and health-related quality of life. Future exercise-related research or implementation strategies in this cohort should focus on cultural awareness and techniques to enhance participation and compliance. Our approach to cultural consultation could be considered by researchers undertaking trials in this and other ethnic populations suffering an extreme burden of T2DM, including indigenous Australians and Americans.

Key Words

Resistance, Aerobic, Obesity, Maori, Pacific Islands, Polynesia, Ethnic, High-Risk

Background

Significant disparities in health status exist between the indigenous people and non-indigenous people of countries colonised by Great Britain.[1-3] In New Zealand, this disparity has been highlighted in a recent national health survey in which the reported prevalence of type 2 diabetes mellitus (T2DM) was significantly higher among Maori and Pacific Islands (Polynesian) peoples (8.2%) compared to their European counterparts (3.1%).[4] The actual prevalence in the indigenous cohort is likely much higher as many cases remain undiagnosed.[5] Polynesian people also suffer a higher burden of diabetes-related comorbidities[6] and lower life expectancy.[7]

The rift in health status between Polynesian people and those of European descent may be partially explained by the phenotypic expression of a formerly protective "thrifty" genotype.[8] That is, fat-storing genes, historically selected for in Polynesian peoples due to environmental demands, now constitute a health liability. This hypothesis remains controversial;[9] however, recent studies have indeed shown that diabetes-related markers, including fasting insulin, insulin sensitivity, β-cell function, and glucoregulation differ by ethnicity, even after controlling for variables such as age and adiposity.[10] Mechanistic factors, such as fat distribution patterns, have also been shown to vary between Polynesian people

and other ethnicities.[11]

There is clear evidence that Polynesian health has been significantly compromised by colonisation.[12-14] Ubiquitous processed foods and extreme physical inactivity, the lasting effects of colonisation (i.e. westernisation), tend to unmask a propensity towards cardiometabolic diseases in this population. Additional insidious contributors to the declines in health status since colonisation include inequalities in income, education, employment, housing[15] as well as interpersonal and institutional racism and discrimination.[16] These factors impact upon the ability to improve diet and physical activity behaviours.

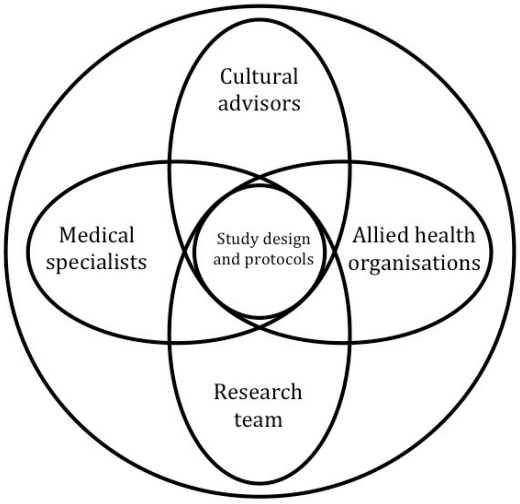
Exercise is essential for the prevention and remission of T2DM. Numerous meta-analyses and review papers underscore the value of progressive resistance training and aerobic training, prescribed independently or in combination, for improved glycaemia control in individuals diagnosed with T2DM.[17-23] However, the majority of trials used to formulate current exercise guidelines have involved primarily Caucasian patients, or the ethnicity was not reported. This is notable given that certain ethnic cohorts are more severely affected by this disease than others. Findings of our recent systematic review suggest a need to investigate the effects of exercise training in Polynesian people with T2DM and other high-risk cohorts.[24]

Our research group recently conducted the first trial to evaluate the effects of prescribed exercise training in Polynesian adults with T2DM.[25,26] The purpose of this study was to determine if exercise could improve glycosylated haemoglobin (HbA1c), related cardio-metabolic markers, and quality of life in this cohort. In order to conduct this study, there were many cultural considerations that had to be taken into account. The study design itself involved extensive consultation with religious and community leaders, as well as potential participants. Documentation of these considerations may prove beneficial for the development and guidance of future exercise intervention trials in this and other distinct ethnic populations. Therefore, the purpose of this paper is to describe our research methodology within the overarching cultural milieu pertinent to establishing a clinical exercise trial acceptable to Maori and Pacific Islands people in New Zealand. Recommendations will be provided to guide exercise scientists, healthcare professionals and researchers in undertaking future exercise studies or treatment initiatives in this cohort and other high-risk ethnic populations.

Cultural consultation and ethics

Maori and Pacific research in New Zealand must be conducted in a culturally sensitive manner. In conceptualising our study, we consulted with indigenous community and healthcare leaders throughout the Porirua and Wellington regions for nearly 18 months prior to enrolling the first participant. A schematic of the consultation process is presented in Figure 1.

Figure 1: Cultural consultation schematic



Cultural consultation consisted of meetings with, and presentations to, Maori and Pacific community leaders and healthcare liaisons. Proposed research protocols and participant literature (e.g. information sheets, consent forms, questionnaires) received ongoing review to ensure acceptance and benefit to the Polynesian communities at large. Organisational support and guidance were received from the National Heart Foundation's Pacific Heartbeat liaison, Capital and Coast District Health Board, Ora Toa Health Services, and Pacific Health Services in Wellington.

The consultation process revealed that potential participants considered randomisation to a non-exercise control group unethical. This issue was also noted in a previous lifestyle intervention trial enrolling Polynesian participants.[27] Our study design was therefore modified from a randomised controlled trial comparing resistance training to usual care (no exercise) to a trial evaluating and comparing the effect of resistance and aerobic training.

All feedback was integrated into our research proposal, which received approval from cultural and religious liaisons prior to being submitted to, and approved by, the Central Regional Ethics Committee (Approval Number; CEN/07/08/054). Final ethics approval was obtained within four months, while the first participants were recruited five months thereafter.

Recruitment process

Healthcare professionals with the various agencies

initially provided our recruitment flyer to potentially eligible individuals, however this strategy enrolled few participants. We addressed this issue by having general practitioners and practice nurses forward the names and contact telephone numbers, with permission, of interested and potentially eligible participants. We then initiated first contact. The first wave of participants referred friends, family, co-workers, and fellow church congregants to the study similar to the "snowball effect" previously described by Murphy et al.[27] Several potential participants also contacted the lead investigator after reading articles about the study in regional and national print media or after viewing reports delivered via the televised national news.

Medical review

Individuals were selected for participation in the exercise study if they met the following criteria: 1) self-identified Polynesian (Maori or Pacific Islands) descent; 2) a clinical diagnosis of T2DM; 3) visceral obesity (i.e. waist circumference of >88cm for women and >102cm for men); 4) physically inactive for > 6 months; 5) no change in diabetes medications for previous two months; and 6) no acute or chronic medical conditions for which exercise would be contraindicated as outlined by the American College of Sports Medicine.[28] All protocols and safety procedures were developed in partnership with a consultant diabetes specialist and were in accordance with established international safety guidelines set forth by the American Diabetes Association[29] and the American College of Sports Medicine.[28]

After initial medical screening, potential participants were invited, along with supportive family and/or friends for a private consultation to learn more about the study and ask questions, prior to providing informed consent. The principal investigator also made home and office visits to accommodate busy work and family schedules. Approval was also obtained from the respective physician and/or endocrinologist.

Exercise venue

The trial was conducted at a commercial health and fitness facility (*City Fitness*©) in Porirua, New Zealand, approximately 20 minutes drive north of Wellington. The population of Porirua is approximately 48,546 people and 46.5% are of Polynesian descent, which is much higher than the national average of 19.6%.[30] Accordingly, *City Fitness*© has a high Maori, Pacific, and mixed Polynesian/European membership base. Our participants, most of which had never previously exercised, received free memberships for the duration of the intervention period (16 weeks). Management also allocated staff and office space to facilitate study procedures. Exercise training sessions were conducted in the circuit fitness area of the gym, which offered a degree of privacy to our participants.

Exercise leaders

Qualified exercise physiologists led all exercise sessions. Four advanced Exercise Science students from Massey University and three qualified personal trainers from *City Fitness*© provided one-on-one supervision to participants which helped ensure both safety and compliance to training procedures. Foliaki and Pearce[31] have noted that behaviour modification interventions in Polynesian people are more likely to succeed with the involvement and support of family and community members. It is notable that four of the seven exercise physiologists were of Maori and/or Pacific heritage. Several Maori and Pacific Island community leaders involved in the initial cultural consultation were also paying members of the facility and periodically provided on-site encouragement to participants. Participants were also encouraged to bring family and friends to watch, participate in the training, and/or support their efforts. A level of camaraderie developed amongst participants, as they spoke freely about their health issues, and offered encouragement to one another. Many exchanged phone numbers and emails to maintain contact outside study hours and some carpooled to the exercise sessions.

Exercise sessions

Participants were randomised to either an aerobic training group or a resistance training group. The two groups exercised in parallel three sessions per week (Monday, Wednesday, Friday) for 16 weeks. The duration of each session ranged from 40 to 60 minutes. The exercise regimens were developed in accordance with guidelines published by the American College of Sports Medicine.[32] Pre- and post-exercise heart rate, blood pressure, and blood glucose (via Accu-Chek Performa glucometer, Roche Diagnostics, Auckland, New Zealand) were monitored and recorded at each session. The lead exercise physiologist was delegated to maintain ongoing communication with the diabetes management team (e.g. endocrinologist, general practitioner, diabetes nurse specialist) of each participant, which involved reporting of untoward signs or symptoms, if experienced.

Resistance Training: after a five-minute warm-up, participants performed eight machine-based resistance exercises in a circuit format designed to target all major muscle groups: seated leg press, knee extension, knee flexion, chest press, lat pull-down, overhead press, biceps curls, triceps extension (Cybex International, Medway, MA). Due to the level of physical deconditioning in our cohort, we were concerned about the severity of delayed onset muscle soreness (DOMS) that could be elicited by

intervention[33] and the impact it might have on attrition. We therefore employed a graduated periodised regimen. Participants performed six to eight repetitions with one minute of rest provided between sets. Workloads were increased by 3–5% when participants could perform 10 repetitions. Weeks 4, 8, and 12 were designated active recovery weeks in which participants performed one set of each exercise at a weight 10% less than the previous week's peak workload. Participants were encouraged to exercise at a perceived exertion of "very hard" on the Borg scale.[34] The high staff to participant ratio assured compliance with protocols.

Aerobic Training: participants performed a graduated progressive cycle ergometry (*Life Fitness*, Schiller Park, IL) protocol. This protocol was specifically employed to facilitate cardiovascular conditioning and promote fat loss. Participants were familiarised with the equipment and gradually progressed from 65 to 85% of their calculated heart rate reserve[28] and encouraged to sustain a perceived exertion of "very hard".[34] Heart rate and blood pressure were monitored and recorded at peak steady state workloads. Cycle resistance and the duration at peak intensity were increased by 3–5% to accommodate improved fitness levels over time.

Assessments of outcomes

Outcome measures were collected before and after the exercise intervention period. The primary endpoint was HbA1c and secondary endpoints included: insulin resistance, blood lipids, relevant cytokines (C-reactive protein, adiponectin), and anthropometric and haemodynamic indices. Health history assessment and specific questionnaires, including Medical Outcomes Trust Short-Form 36 (SF-36) quality of life survey[35] were completed at *City Fitness*©, while medical procedures were completed at Kenepuru Hospital, also located in Porirua. The hospital is a trusted healthcare institution within the community, with multilingual signage and culturally diverse staff. Research staff greeted participants upon arrival at the hospital and guided them to the exam rooms. Hospital staff performed fasting blood draws, while research staff conducted anthropometric and haemodynamic assessments. Skeletal muscle biopsies were taken from the vastus lateralis muscle and were conducted by a trained medic with extensive experience in the procedure. Participants were provided with an opportunity to speak with the attending physician, ask questions prior to the procedure, and reserved the right to refuse the procedure. A separate written informed consent was provided for the biopsy procedure only, as recommended by the cultural consultation process.

Acceptability to participants

City Fitness© in Porirua provided a welcoming and supportive group atmosphere anecdotally reported to be acceptable by participants. Participants often spoke their own language with staff, club members, and fellow participants. Participants occasionally attended exercise sessions dressed in traditional clothing, and sometimes engaged in prayer together. Exercise staff and research team members maintained a high-level of cultural awareness and made every effort to accommodate participants. For example, exercise sessions were provided outside usual class times, if needed, to allow for participants to meet pre-existing family, religious, or employment commitments. Many participants expressed their satisfaction with the exercise program, but acknowledged that it would be difficult to maintain without ongoing support and encouragement. *City Fitness*© provided discounted memberships to participants upon completion of the intervention. A number of participants carried on at *City Fitness* while others purchased memberships at other fitness centres or recreation facilities in the vicinity.

Participant attrition

Eighteen of 26 randomised participants completed the study. The most common reasons for dropping out included: work-related commitments (n=4), living too far from training venue (n=1), and new pregnancy (n=1). Two participants provided no reason for discontinuation. Attendance became an issue for several participants that eventually completed the study. Eleven of 18 participants completed at least 32 of 48 (66.7%) available sessions. The main reasons given for missed sessions included: work, family, flu, funerals, and pre-existing obligations planned prior to joining the study.

Recommendations

A number of recommendations can be provided to researchers conducting exercise intervention trials with Maori and Pacific Islands people. Extensive consultation and a thorough awareness and sensitivity to important cultural underpinnings should be integrated into the study. Although this is a requirement of New Zealand ethics committees, it is also imperative for establishing trust with Polynesian communities and potential participants as some members of this community appear sceptical of research, and are unaware of the need to create wider dissemination of research outcomes. Virtually all participants joined the study because they were recruited through people they knew and trusted.

The training venue must preserve and reinforce cultural and ethnic identities. An ideal location would perhaps be the Marae (i.e. sacred Maori meeting place for religious

and social gatherings) or the Pacific church, but this might prove unfeasible without the necessary exercise equipment and space. Our study demonstrated that a commercial fitness centre within a Polynesian community was an acceptable and feasible alternative.

Participant attrition and less than optimal attendance were identified problems, but the reasons provided were not unlike those reported in other clinical trials of exercise training. Future exercise studies should place greater emphasis on maintaining recruitment and motivation. Financial incentives and an extrinsic rewards system (e.g. vouchers, gifts) may enhance compliance over the long-term. The involvement of a behavioural psychologist may also enhance adherence with greater emphasis being placed on the identification of intrinsic motivators and the determination and facilitation of behavioural change as elucidated by Prochaska and Velicer.[36] Further, interventions that are more practicable, that involve whole families or groups, may prove more beneficial for participant retention. It has been suggested that behaviour modification in Polynesian people is more likely to succeed with the involvement and support of family and community members.[31] Traditional forms of exercise (e.g. paddling and dance) may be most accepted and desirable.

Our initial intent to carry out a randomised control trial comparing a resistance training group to a non-exercising control group proved untenable. Preliminary discussions with potential participants indicated that few would accept random allocation to a non-exercise group. Future cultural consultations could perhaps be directed toward ensuring more rigorous scientific study designs. For example, if non-exercising control group remains unacceptable, unequated training regimens could be compared (e.g. aerobic training versus aerobic plus resistance training). Wait-list or cross-over study designs could also be employed. Future studies involving focus groups and qualitative methods may be required to determine which types of research methodologies are most feasible and desirable.

We attempted to maintain records of confounding variables including physical activity and diet. However, we identified ongoing problems with incomplete or missing responses on questionnaires. In particular, many participants stated the International Physical Activity Questionnaire (IPAQ)[37] was too daunting and confusing. The three-day dietary food record was particularly difficult to administer due to difficulties with serving size estimation and recall of meals.

The Medical Outcomes Trust Short-Form 36 (SF-36) quality of life survey has been validated in the New Zealand population, but a high number of missing responses in Pacific people has also been reported.[38] In the present study we did note missing responses primarily due to item oversight. Administration of SF-36 alternatives such as the SF-12 or SF-8 might be more feasible in future studies. Future investigations should strive to choose or develop health questionnaires that are simple, use minimal scientific jargon, are visually uncluttered, and easy to administer.

In summary, Maori and Pacific Islands people suffer disproportionately from T2DM and associated cardiometabolic aberrations compared to New Zealanders of European descent. A significant body of evidence supports the use of resistance training and aerobic exercise as potent therapeutic modalities for enhanced T2DM management in predominantly Caucasian-European participants. Both exercise modalities still remain largely under prescribed and underutilised in clinical practice, especially in indigenous populations with T2DM. Ample opportunity exists within New Zealand to extend the benefits of exercise to high risk Maori and Pacific Islands people. The successful development and implementation of the present study demonstrates that a structured exercise intervention is both feasible and acceptable to Polynesian New Zealanders with T2DM, and efforts are indeed required to target the diabetes epidemic in this specific ethnic population. Our approach to cultural consultation could be implemented in trials enrolling other ethnic populations highly afflicted with diabetes including indigenous Australians and indigenous Americans.

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CONFLICTS OF INTEREST

The authors declare that they have no competing interests.

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ETHICS COMMITTEE APPROVAL

Central Regional Ethics Committee (Approval Number; CEN/07/08/054).