

Challenges and Opportunities for Physical Activity Interventions in Type 2 Diabetes Mellitus sufferers in Indigenous Areas throughout the world: A Scoping Review

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Abstract

Physical activity interventions play a crucial role in managing Type 2 Diabetes Mellitus (T2DM) in Indigenous populations. However, there are significant challenges in implementing these interventions in Indigenous areas, including limited access to facilities, cultural barriers, and environmental factors. This scoping review aimed to identify and summarize the challenges and opportunities for physical activity interventions in Indigenous areas for individuals with T2DM. This scoping review utilized a comprehensive search strategy to identify relevant literature from various electronic databases. The literature search was focused on studies that explored physical activity interventions in Indigenous populations with Type 2 Diabetes Mellitus. The search strategy resulted in the identification of several studies that highlighted the challenges and opportunities for physical activity interventions in Indigenous areas for individuals with Type 2 Diabetes Mellitus. Numerous challenges were identified, including limited access to recreational facilities, cultural barriers, and environmental factors. Limited access to recreational facilities was one of the key challenges identified in the literature. The challenges faced in implementing physical activity interventions in Indigenous areas for individuals with T2DM are significant, particularly limited access to recreational facilities, cultural barriers, and environmental factors. However, there are also opportunities for addressing these challenges and improving physical activity interventions in Indigenous areas for individuals with T2DM. One opportunity is the incorporation of cultural aspects into physical activity interventions, such as traditional Indigenous physical activities.

Keywords: *challenges, Indigenous areas, opportunities, physical activity interventions, Type 2 Diabetes Mellitus.*

Introduction

The challenge of implementing physical activity interventions for Type 2 Diabetes Mellitus (T2DM) sufferers in Indigenous areas is a complex and multifaceted issue. Numerous studies have highlighted the disproportionately high rates of T2DM among Indigenous populations, particularly in countries like New Zealand and Australia. To address these inequitable health outcomes, there is a growing recognition of the need for culturally appropriate and accessible lifestyle interventions, such as physical activity programs. However, there is a lack of research on the physical activity levels of people with T2DM in Indigenous communities, making it unclear what types of interventions would be successful in these populations (Hale et al., 2022). The scoping review conducted by the researchers aims to

identify and analyze the challenges and opportunities for physical activity interventions in T2DM sufferers in Indigenous areas worldwide and provide recommendations for future interventions.

One key challenge identified in the review is the limited number and quality of published intervention studies in Indigenous populations with T2DM. A review of the literature revealed that while there has been an overall increase in publications on diabetic Indigenous health, the research predominantly remains descriptive. Furthermore, the proportion of research involving interventions is still low, with only 12% of studies focusing on interventions. Out of the few intervention studies that have been conducted, only a limited number meet the standard criteria set by the Cochrane Effective Practice and Organization of Care (Schoen & Norman, 2014).

This lack of high-quality intervention studies poses a challenge in developing evidence-based physical activity interventions for T2DM sufferers in Indigenous areas. Furthermore, the review also highlights the challenge of achieving optimal levels of physical activity among T2DM sufferers in Indigenous communities. Limited research on physical activity engagement in Indigenous peoples in countries like New Zealand and Australia makes it difficult to determine the types of interventions that would be successful in encouraging physical activity in these populations (Hale et al., 2022). In addition to the challenges, there are also opportunities for physical activity interventions in Indigenous areas for T2DM sufferers.

For example, there is a growing recognition of the importance of culturally appropriate interventions in addressing health disparities among Indigenous populations. Culturally appropriate physical activity programs have the potential to engage and motivate T2DM sufferers in Indigenous communities to participate in regular physical activity. These programs can incorporate traditional activities such as walking clubs, weight-loss groups, community gardens, traditional food harvesting activities, canoeing, and dancing (Liberda et al., 2020). By incorporating cultural elements into physical activity interventions, they can resonate with the Indigenous population and promote a sense of community and belonging. Furthermore, self-monitoring of blood glucose levels can serve as an effective method for individuals to assess the effectiveness of a physical activity program. Moreover, there is an opportunity to collaborate with Indigenous communities and involve them in the development and implementation of physical activity interventions (Nykiforuk et al., 2018).

This collaboration can ensure that the interventions are culturally appropriate, acceptable, and sustainable in Indigenous communities. By involving Indigenous communities in the

planning and execution of physical activity interventions, there is a greater likelihood of success and long-term adherence. Overall, the challenges and opportunities for physical activity interventions in Indigenous areas for T2DM sufferers are closely intertwined. On one hand, the limited research on physical activity engagement in Indigenous peoples poses a challenge in determining effective interventions (Hale et al., 2022).

On the other hand, the recognition of the importance of culturally appropriate interventions provides an opportunity to engage Indigenous communities and develop programs that resonate with their cultural values and traditions. Moreover, it is important to recognize that disease management in Indigenous communities can have cultural and spiritual connotations (Maor et al., 2022). This understanding is crucial in bridging the gap between healthcare providers and Indigenous communities, as well as other ethnic groups. Furthermore, addressing the inequitable health outcomes experienced by Indigenous populations with T2DM requires a multifaceted approach that goes beyond physical activity interventions alone and includes access to healthcare, nutrition education, and addressing social determinants of health (Hale et al., 2022). One possible intervention approach in Indigenous areas is the incorporation of cultural activities into physical activity programs. By incorporating traditional Indigenous activities such as traditional food harvesting, canoeing, and dancing into physical activity interventions, there is an opportunity to promote a sense of cultural pride and connection to traditional practices, while also promoting physical health and well-being. In addition to incorporating cultural activities, it is crucial to provide culturally appropriate and accessible non-pharmaceutical lifestyle interventions, such as physical activity programs (Thomas et al., 2019). Indigenous communities often face barriers to accessing healthcare and participating in interventions due to factors such as geographical remoteness, limited resources, and historical traumas. Therefore, it is imperative to ensure that physical activity interventions in Indigenous areas are accessible, convenient, and tailored to the specific needs and cultural contexts of the community. Furthermore, self-monitoring of blood glucose levels can be an effective method for individuals to assess the effectiveness of a health-and-wellness program (Liberda et al., 2020).

Overall, the challenges for physical activity interventions in Type 2 Diabetes Mellitus sufferers in Indigenous areas throughout the world are rooted in a lack of understanding of the unique cultural values, traditions, and social determinants of health that influence physical activity engagement in these communities (Hale et al., 2022). Addressing these challenges

requires a comprehensive approach that considers the cultural significance of physical activity, incorporates traditional Indigenous activities, and ensures accessibility and cultural appropriateness of interventions. Furthermore, it is essential to involve the Indigenous communities themselves in the design and implementation of physical activity interventions.

This scoping review aimed to explore the challenges and opportunities for physical activity interventions in Type 2 Diabetes Mellitus (T2DM) sufferers in Indigenous areas throughout the world. The review found that there is a lack of research on physical activity levels and interventions specific to T2DM in Indigenous populations, particularly in countries like New Zealand and Australia. To address this gap, it is crucial to conduct further research to understand the physical activity behaviors and determinants in Indigenous communities.

Method

Study Design

This scoping review utilized a systematic search strategy to identify relevant studies on physical activity interventions in Type 2 Diabetes Mellitus (T2DM) sufferers in Indigenous areas throughout the world. The review included studies conducted in various Indigenous communities globally and aimed to identify the challenges and opportunities for physical activity interventions in these populations (Uusitupa et al., 2019).

Study Protocol

The study protocol was developed following the guidelines recommended by Arksey and O'Malley for scoping reviews (Abdulaziz et al., 2023).

Search Strategies

The search strategy involved searching electronic databases including PubMed, Scopus, Google Scholar, and Web of Science for relevant articles published between January 2013 and December 2023. The search terms included variations of "physical activity," "interventions," "Type 2 diabetes mellitus," and "Indigenous populations." Additionally, manual searches of reference lists and citation tracking were conducted to identify additional relevant studies.

Study Selection

The included studies in this scoping review were assessed for eligibility based on predetermined inclusion and exclusion criteria. The inclusion criteria for this review were as follows: 1. The study included interventions focused on physical activity in Type 2 Diabetes Mellitus sufferers, 2. The study included Indigenous populations in different regions of the

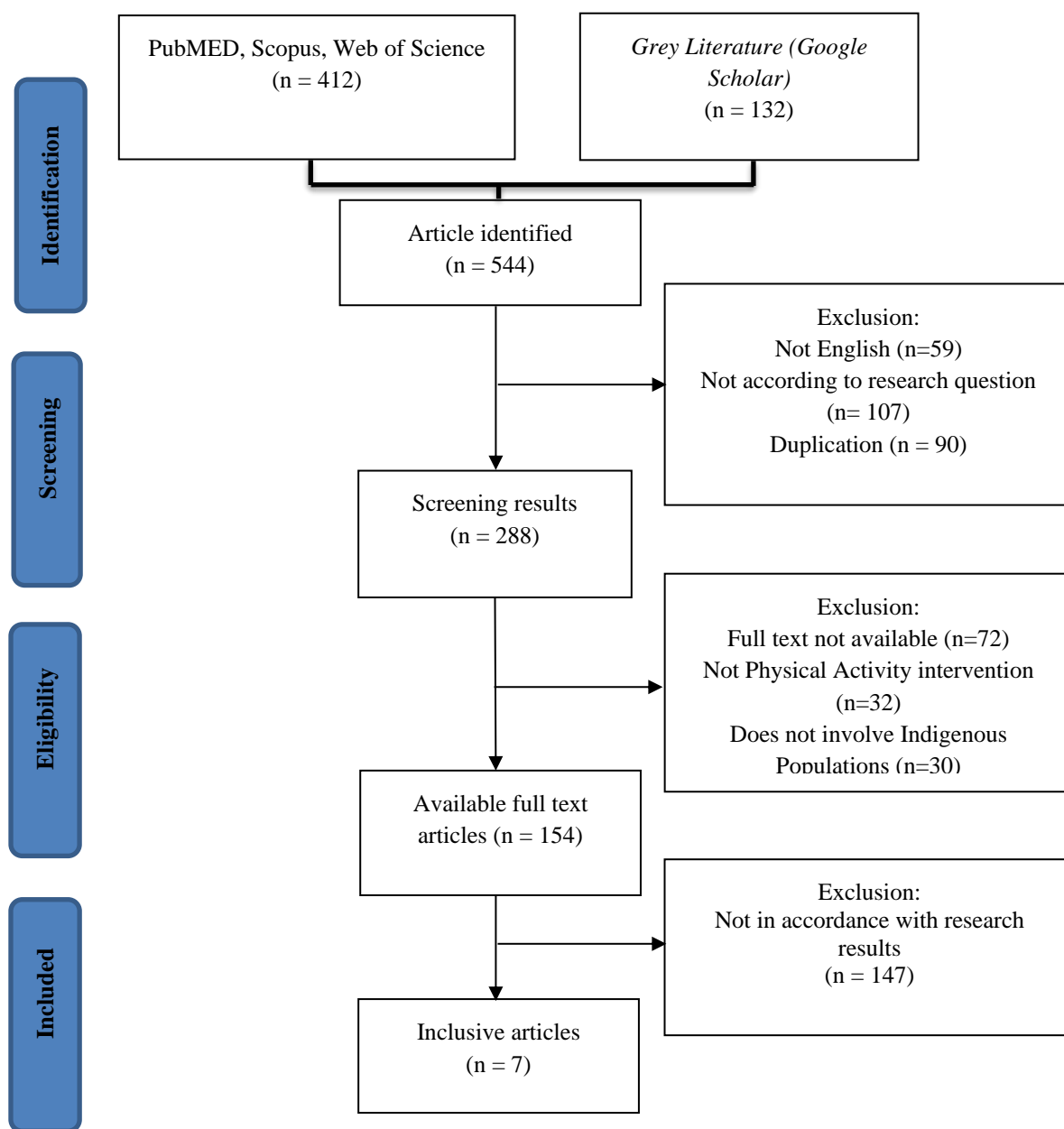
world, 3. The study included information on the challenges and opportunities for physical activity interventions in Indigenous populations.

Inclusion criteria & Exclusion criteria

The inclusion criteria for this scoping review were as follows: 1) Studies that focused on physical activity interventions in individuals with Type 2 Diabetes Mellitus in Indigenous populations, 2) Studies conducted in Indigenous communities globally, 3) Studies that provided information on the challenges and opportunities for physical activity interventions in Indigenous populations.

The exclusion criteria for this scoping review were as follows: 1) Studies that did not focus on physical activity interventions in Type 2 Diabetes Mellitus sufferers, 2) Studies that did not include Indigenous populations, 3) Studies that did not provide information on the challenges and opportunities for physical activity interventions in Indigenous populations, 4) Studies that were not published between January 2013 and December 2023 (**Schematic 2**).

Flowchart for inclusion and exclusion studies)



Schematic 2. Flowchart for inclusion and exclusion studies

Data Extraction and Analysis

The data extraction and analysis process involved the following steps: 1. First, two reviewers independently screened the titles and abstracts of the identified articles to determine their eligibility for inclusion in the review.

Next, full-text articles were retrieved for the potentially eligible studies and were assessed for eligibility based on the predetermined inclusion and exclusion criteria. Data extraction was performed by two reviewers independently using a standardized data extraction form. The extracted data included information on the study design, participant characteristics,

intervention details, outcome measures, and findings related to challenges and opportunities for physical activity interventions in Indigenous populations with Type 2 Diabetes Mellitus.

Results

General Characteristic

The scoping review aimed to identify and analyze studies that focused on physical activity interventions in Type 2 Diabetes Mellitus sufferers in Indigenous populations around the world. According to the review of published interventional studies in Type 2 Diabetes Mellitus in Indigenous populations of Australia, Canada, New Zealand, and the USA, it was found that the number of publications increased over time, indicating a growing interest in research related to diabetic Indigenous health (Schoen & Norman, 2014). However, the majority of the research in this area is descriptive in nature and a small proportion of studies involve interventions. Out of the total publications, only 12% involved interventions, with a significant increase from 3% in the 20 years. Of the intervention studies identified, only seven met the Cochrane Effective Practice and Organization of Care standard, indicating a limited number of high-quality intervention studies in this field. The lack of high-quality intervention studies in physical activity interventions for Type 2 Diabetes Mellitus sufferers in Indigenous populations highlights a significant challenge in addressing the health disparities faced by these communities (Hale et al., 2022). Furthermore, the review highlighted the lack of research specifically focusing on the physical activity levels of people with Type 2 Diabetes Mellitus in New Zealand. Furthermore, the review found that there is a disproportionately higher prevalence of Type 2 Diabetes Mellitus among Māori and Pacific people in New Zealand compared to other ethnic groups. **(Table.1. Study Findings)**

Physical Activity and Its Impact on Type 2 Diabetes

Physical activity plays a crucial role in the management and prevention of Type 2 Diabetes Mellitus. Several sources indicate that physical activity is an essential strategy for the management of Type 2 Diabetes Mellitus (Yazid & Busthomy, 2022).

Similarly, some other researchers have found that interventions using the types of behavioral approaches that these diabetes self-management programs used have led people with Type 2 Diabetes Mellitus to increase their physical activity levels, although not to the extent recommended by public health guidelines (Williams-Piehotu et al., 2009). A scoping review was conducted to explore the challenges and opportunities for physical activity interventions in Type 2 Diabetes Mellitus sufferers in Indigenous areas throughout the world

and found that there is a lack of high-quality intervention studies in this area (MacMillan et al., 2014). Moreover, the review revealed a disproportionate prevalence of Type 2 Diabetes Mellitus among Indigenous populations, particularly among Māori and Pacific people in New Zealand

The challenges surrounding physical activity interventions for Type 2 Diabetes Mellitus sufferers in Indigenous areas are numerous. One significant challenge is the limited number of high-quality intervention studies in this field. This lack of research hinders the development of effective and evidence-based interventions tailored to the specific needs and circumstances of Indigenous communities. Additionally, the review identified various barriers to physical activity among Indigenous populations with Type 2 Diabetes Mellitus, including time constraints, unwillingness, poor awareness levels, comorbid conditions, social issues, lack of infrastructure, and insufficient emphasis by healthcare professionals (Paudel et al., 2022).

These barriers highlight the importance of developing culturally appropriate interventions that take into account the unique cultural, social, and environmental factors that may impact physical activity among Indigenous communities. Furthermore, the review also identified opportunities for physical activity interventions in Indigenous areas. One key opportunity is the potential for increasing physical activity levels to prevent or delay the development of Type 2 Diabetes Mellitus in high-risk Indigenous communities (Mendham et al., 2015). By engaging in sufficient physical activity, Indigenous individuals can reduce their risk of developing Type 2 Diabetes Mellitus and improve glycemic control among those already diagnosed with the condition. The findings of the scoping review emphasize the need for culturally acceptable and person-centered interventions that address the barriers to physical activity in Indigenous populations with Type 2 Diabetes Mellitus.

Existing Physical Activity Interventions in Indigenous Populations

Existing physical activity interventions in Indigenous populations with Type 2 Diabetes Mellitus are limited in their number and quality. This lack of research hinders the development of effective and evidence-based interventions tailored to the specific needs and circumstances of Indigenous communities. (McCabe et al., 2015) To address this challenge, researchers and healthcare professionals need to prioritize the development and implementation of high-quality intervention studies in Indigenous areas. Furthermore, these interventions must be culturally appropriate and take into account the unique cultural, social, and environmental factors that may impact physical activity among Indigenous populations. Some potential strategies for

improving physical activity interventions in Indigenous populations with Type 2 Diabetes Mellitus include:

- a. Collaboration with Indigenous communities: Engaging directly with Indigenous communities in the development and implementation of physical activity interventions can help ensure that interventions are culturally appropriate and meet the needs and preferences of community members (Wilk et al., 2018)
- b. Tailoring interventions to individual needs: Recognizing that each individual has unique barriers and facilitators to physical activity, interventions should be personalized to address these individual factors and provide support in overcoming barriers (Liberda et al., 2020)
- c. Use of traditional Indigenous activities: Incorporating traditional Indigenous activities, such as hunting, fishing, and traditional dances, can enhance the cultural relevance of physical activity interventions in Indigenous populations. These activities can not only promote physical fitness but also preserve cultural traditions and values (Sushames et al., 2016)
- d. Addressing socioeconomic factors: Socioeconomic factors such as poverty, limited access to resources, and educational disparities can significantly impact physical activity levels in Indigenous populations. Interventions should address these socioeconomic factors by providing resources and support to overcome barriers related to poverty, improving access to affordable healthy food options and safe recreational facilities, and promoting education and awareness about the importance of physical activity for managing diabetes (Sushames et al., 2016)(Dahlberg et al., 2018)
- e. Incorporating peer support and community involvement: Peer support and community involvement can play a crucial role in promoting physical activity among Indigenous populations. Interventions should incorporate peer support networks and involve community members in the planning and implementation of physical activity programs (Warburton & Bredin, 2019b)
- f. Providing education and resources: Many Indigenous populations may have limited access to information and resources related to physical activity and diabetes management. Interventions should include education and the provision of resources such as informational materials, workshops, and access to healthcare professionals who can provide guidance and support (Wood et al., 2021)

Physical activity interventions in Indigenous areas must address the unique challenges and opportunities that these populations face (Singh et al., 2023). These interventions should be developed in collaboration with the community to ensure their relevance and effectiveness. Furthermore, it is important to integrate Indigenous beliefs, values, and cultural practices into the research process. By doing so, interventions can be tailored to meet the specific needs and preferences of Indigenous populations, increasing the likelihood of success. Physical activity interventions in Indigenous areas face various challenges that must be considered and addressed (Pelletier et al., 2020). One of the main challenges is limited access to recreational facilities and resources in rural and remote Indigenous communities. This lack of access can make it difficult for individuals in these communities to engage in regular physical activity. In addition, environmental barriers such as poor lighting, uneven road surfaces, and inclement weather can further hinder physical activity opportunities (McCabe et al., 2015). To overcome these challenges, interventions should focus on providing resources and support to overcome barriers related to poverty, improving access to affordable healthy food options and safe recreational spaces, and addressing transportation limitations. Another challenge is the cultural and social barriers to behavior change. Indigenous populations may have different beliefs, values, and practices when it comes to physical activity (Wilk et al., 2018). Addressing these cultural and social barriers is crucial for the success of physical activity interventions. It is important to engage with Indigenous community leaders and members when developing interventions, ensuring that their perspectives and values are integrated into the program design. (Warburton & Bredin, 2019).

Evaluation of Physical Activity Interventions

To determine the effectiveness of physical activity interventions in Indigenous areas, it is important to evaluate their impact on health outcomes related to physical activity. This can be done through rigorous research methodologies such as randomized controlled trials or quasi-experimental designs. These studies should assess not only the immediate effects of the intervention on physical activity levels, but also its long-term impact on health outcomes such as fitness levels, blood pressure, and other chronic disease risk factors (Pelletier et al., 2020)(Dahlberg et al., 2018). Moreover, it is crucial to consider the sustainability and scalability of interventions in Indigenous areas. This can be achieved by analyzing the feasibility and cost-effectiveness of interventions, as well as considering their cultural

appropriateness and adaptability to different Indigenous cultures and contexts (Gall et al., 2021).

Cultural Relevance of Physical Activity Interventions To ensure the cultural relevance of physical activity interventions in Indigenous areas, it is essential to engage with community leaders and members throughout the intervention development and implementation process (Nykiforuk et al., 2018).

This can be achieved through community-based participatory research methods, where Indigenous communities are actively involved as partners in the research process. Including Indigenous leaders and community members in all stages of the intervention helps to ensure that the program is respectful of cultural beliefs, values, and practices (Liew et al., 2022). Furthermore, cultural relevance also involves incorporating traditional practices and teachings related to physical activity into the intervention. For example, incorporating traditional Indigenous games, dances, or outdoor activities can not only increase engagement and participation but also promote a sense of cultural pride and connection to physical activity.

Addressing Social Determinants of Indigenous Physical Activity

When designing physical activity interventions in Indigenous areas, it is crucial to consider the social determinants that influence physical activity levels within these communities (McCabe et al., 2015). These social determinants can include factors such as access to safe recreational spaces, transportation barriers, socio-economic factors, historical trauma, and the impact of colonization on Indigenous peoples' health and well-being. By acknowledging and addressing these social determinants, interventions can be better tailored to the specific needs and challenges faced by Indigenous communities. One challenge in addressing the social determinants of Indigenous physical activity is the lack of understanding of the meaning and impact of physical activity from an Indigenous standpoint (Sushames et al., 2016). To bridge this gap, future interventions should involve Indigenous perspectives and incorporate cultural knowledge and practices. Additionally, the development and implementation of physical activity interventions should take into account the unique cultural contexts and diversity within Indigenous communities. By recognizing and respecting the distinct cultural backgrounds, languages, and traditions of different Indigenous groups, interventions can be more inclusive and effective. One opportunity for physical activity interventions in Indigenous communities is the use of community-based participatory research methods (Kerpan et al., 2021).

Challenges in Physical Activity Interventions

The scoping review identified several challenges in implementing physical activity interventions for Type 2 Diabetes Mellitus sufferers in Indigenous populations.

Firstly, the lack of culturally appropriate and accessible interventions poses a significant barrier. Indigenous populations often have unique cultural practices, beliefs, and values that need to be taken into consideration when designing interventions (Sushames et al., 2016). For example, traditional healing practices or spiritual beliefs may influence the acceptability and effectiveness of certain physical activity interventions. Secondly, limited resources and infrastructure in Indigenous areas pose challenges for implementing physical activity interventions. Many Indigenous communities face limited access to recreational facilities, safe outdoor spaces, and affordable exercise equipment. This lack of resources and infrastructure can hinder individuals' ability to engage in physical activity and may contribute to the lower levels of physical activity observed in Indigenous populations compared to non-Indigenous populations (Wood et al., 2021).

Thirdly, historical and ongoing social determinants of health contribute to the challenges faced in implementing physical activity interventions for Indigenous populations. Historical trauma, colonization, discrimination, and socioeconomic disparities are all factors that can impact Indigenous individuals' access to and engagement in physical activity. These challenges, coupled with comorbid conditions and poor awareness levels about the benefits of physical activity, further compound the difficulty of implementing interventions (Shahram et al., 2017) (Santos et al., 2022).

Opportunities in Physical Activity Interventions

Despite the challenges, there are also opportunities for physical activity interventions in Indigenous populations with Type 2 Diabetes Mellitus.

One opportunity lies in the recognition of the importance of culturally tailored interventions. By designing interventions that are culturally appropriate and responsive to the needs and preferences of Indigenous populations, there is a greater likelihood of engagement and positive outcomes (Pelletier et al., 2020).

Culturally tailored interventions may involve incorporating traditional healing practices, integrating cultural teachings and traditions into physical activity programs, and collaborating with Indigenous community members to ensure that the interventions align with their values and beliefs. Furthermore, involving Indigenous community members in the planning,

implementation, and evaluation of physical activity interventions can help to build trust and ownership within the community (Liberda et al., 2020)(Lewis et al., 2021).

Another opportunity lies in the use of technology and digital solutions to overcome the barriers of limited resources and infrastructure. By utilizing mobile applications, online platforms, and virtual programs, individuals in Indigenous communities can access physical activity resources and guidance regardless of their geographic location(Pelletier et al., 2020)(Lewis et al., 2021). These technological solutions can provide educational resources, workout routines, tracking tools, and virtual coaching to support individuals in their physical activity journeys. Furthermore, community-based approaches can also be effective in promoting physical activity among Indigenous populations (Wood et al., 2021). These approaches involve working directly with communities to develop and implement physical activity programs that address specific needs and preferences. Community members can provide valuable insights into the barriers and facilitators of physical activity within their community, which can inform the design of effective interventions. Moreover, community-based approaches can promote a sense of ownership and empowerment among Indigenous populations, as they are actively involved in decision-making processes and have a voice in shaping the interventions (Jones et al., 2017).

Success Stories of Physical Activity Interventions

There have been several success stories of physical activity interventions in Indigenous communities that highlight the potential for positive outcomes. One example is a research project conducted in collaboration with Indigenous community leaders and non-Indigenous partners, which investigated outcomes that were of value to the community, such as improved physical fitness and overall health(Robin, 2019). These interventions utilized a family-oriented perspective of teaching and learning that aligned with local teachings and cultural values. The findings of this project showed significant improvements in fitness and blood pressure among participants, indicating the effectiveness of culturally relevant physical activity interventions in Indigenous communities (Sushames et al., 2016). Additionally, a study conducted with Indigenous students emphasized the importance of collaboration with the community in developing physical activity interventions (Kerpan et al., 2021). The study found that involving community members in the design and implementation of the intervention ensured that the outcomes, processes, and activities were important and relevant to the community(Bantry-White et al., 2018).

Discussion

The challenges of implementing physical activity interventions in Indigenous areas are evident. Limited access to recreational facilities, poor infrastructure such as sidewalks and road surfaces, inclement weather, and wildlife can all pose barriers to physical activity (Singh et al., 2023). However, despite these challenges, there are opportunities for interventions to be successful. By engaging with Indigenous communities, understanding their specific needs and preferences, and incorporating cultural values and teachings into the design of interventions, physical activity programs can be tailored to the unique context of Indigenous communities (Warburton & Bredin, 2019a). This approach promotes a sense of ownership and empowerment among Indigenous populations, as they are actively involved in decision-making processes and have a voice in shaping the interventions that impact their health. One key opportunity for physical activity interventions in Indigenous areas is the potential for community engagement and collaboration (Kerpan et al., 2021).

This collaboration can help ensure that interventions are culturally appropriate, relevant, and effective. It also fosters a sense of trust and respect between researchers and the community, which is crucial for the success of interventions. To address the challenges of limited access to facilities, interventions can incorporate alternative forms of physical activity that can be easily performed in the local environment. For example, traditional activities such as hunting, fishing, or gardening can be integrated into physical activity programs (Yayuk Andayani, Burhanuddin, Aliefman Hakim, INyoman Loka, 2021). These activities not only provide opportunities for physical movement but also align with Indigenous cultures and traditions, enhancing the cultural relevance of the interventions. Furthermore, the involvement of Indigenous mentors and community leaders in the design and implementation of interventions is crucial. Their knowledge, expertise, and understanding of community dynamics can contribute to the development of effective strategies for promoting physical activity.

Another opportunity for physical activity interventions in Indigenous areas is the potential for leveraging existing resources and strengths within the community (MacDonald et al., 2015). This can include utilizing community spaces, such as schools or community centers, for physical activity programs. Additionally, partnerships can be formed with local organizations or businesses that have the necessary resources or facilities to support physical activity initiatives (Pelletier et al., 2020).

For example, collaborating with local sports clubs, recreation centers, or outdoor adventure groups can provide access to facilities and equipment for physical activity programs. Moreover, these partnerships can also provide opportunities for skill-building and training for community members, enabling them to take on leadership roles in facilitating physical activity programs.

In addition to these opportunities, some challenges need to be addressed in implementing physical activity interventions in Indigenous areas (Singh et al., 2023). One of the main challenges is overcoming systemic barriers to physical activity, such as limited access to facilities and resources. Furthermore, the historical and ongoing marginalization of Indigenous communities can create additional barriers to participation in physical activity interventions. These challenges can be addressed through a comprehensive and multidimensional approach that takes into account the complex context of Indigenous communities (Warburton & Bredin, 2019a). This approach should involve collaboration with Indigenous community leaders and stakeholders, as well as engagement with local knowledge and values. It is crucial to involve Indigenous community leaders and stakeholders in the design and implementation of interventions, as they possess valuable insights into the unique cultural and contextual factors that need to be considered. To overcome these challenges, physical activity interventions in Indigenous areas should be culturally appropriate and sensitive. This can be achieved by incorporating traditional Indigenous forms of physical activity, respecting and integrating Indigenous beliefs and values, and ensuring that interventions are community-led and community-owned. Moreover, it is important to recognize and address the specific health needs and concerns of Indigenous individuals living with Type 2 Diabetes Mellitus (Gupta et al., 2022).

This can be accomplished through tailored interventions that focus on diabetes management, education, and support. In conclusion, physical activity interventions in Indigenous areas face both challenges and opportunities. These challenges include limited access to facilities, systemic barriers, and historical marginalization (Sushames et al., 2016). However, by working collaboratively with Indigenous community leaders and stakeholders, there are opportunities to overcome these challenges and create interventions that are culturally relevant and effective (Tamati et al., 2021). Overall, implementing physical activity interventions in Indigenous areas poses unique challenges and opportunities.

Physical activity interventions in Indigenous areas face significant challenges but also provide unique opportunities for improving the health and well-being of individuals living with Type 2 Diabetes Mellitus.

Conclusion

In conclusion, physical activity interventions in Indigenous areas for individuals with Type 2 Diabetes Mellitus face numerous challenges related to limited access to facilities, cultural barriers, and environmental factors (Hale et al., 2022). However, there are significant opportunities for improving the health and well-being of Indigenous individuals with Type 2 Diabetes Mellitus through culturally appropriate and community-led interventions that prioritize community engagement, address barriers specific to Indigenous communities, and cater to the diverse needs and preferences within these communities (Liberda et al., 2020).

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Tabel 1. Study Findings

Paper	Region	Study design	Participant count	Participant age	Intervention	Outcome measured	Findings	Challenges	opportunities
Understanding Sociocultural Influences on Physical Activity in Relation to Overweight and Obesity in a Rural Indigenous Community of Fiji Islands, (Singh et al., 2023)	Fiji Islands	-	14	18 years and over	-	<ul style="list-style-type: none"> • Sociocultural Factors • Economic Factors • Political Factors • Physical Environmental Factors 	The text describes the findings from the data analysis using descriptive thematic analysis, which are categorized under (a) sociocultural, (b) physical, (c) economic, and (d) political environment factors about physical activity in the rural community environment. The text does not provide any specific findings related to the study	The text mentions numerous challenges in developing and implementing physical activity interventions in Indigenous communities. The specific challenges are not mentioned in this excerpt	The text mentions that the provision of opportunities for physical activities and sports is discriminated against iTaukei people in rural communities
A 12-week sports-based exercise program for inactive Indigenous Australian men	Rural New South Wales, Australia	participatory research	26	10-14 years	-	<ul style="list-style-type: none"> • Barriers To Sport And Physical Activity Participation 	The text discusses the barriers and facilitators of sport and	The text identifies 5 level, 3 interpersonal	The text does not answer the question

<p>improved clinical risk factors associated with type 2 diabetes mellitus,(Mendham et al., 2015)</p>							<ul style="list-style-type: none"> • Facilitators Of Sport And Physical Activity Participation <p>physical activity participation for Aboriginal children in rural New South Wales, Australia</p> <p>level, and 2 individual level barriers to sport and physical activity participation for Aboriginal children in rural New South Wales, Australia</p>		
<p>The Barriers and Facilitators of Sport and Physical Activity Participation for Aboriginal Children in Rural New South Wales, Australia: A Photovoice Project, (Liew et al., 2022)</p>	<p>Taranaki Māori worldview</p>	<p>qualitative</p>	<p>23</p>	<p>-</p>	<p>-</p>	<ul style="list-style-type: none"> • Tuakiri (Secure Local Māori Identity) • Whānauranga (Acting As A Member Of Whānau) • Manawaroa (Persisting Despite Difficulty) • Piripono (Integrity, Commitment And Responsibility For A Shared Kaupapa) 	<p>The text does not provide any specific findings</p>	<p>The text does not answer a question</p>	<p>The text does not mention opportunities</p>
<p>Understanding strengths-based Māori child development constructs in Kaupapa Māori</p>	<p>Taranaki Māori worldview</p>	<p>qualitative</p>	<p>23</p>	<p>-</p>	<p>-</p>	<ul style="list-style-type: none"> • Tuakiri (Secure Local Māori Identity) • Whānauranga (Acting As A 	<p>The text does not provide any specific findings</p>	<p>The text does not answer a question</p>	<p>The text does not mention opportunities</p>

<p>early years provision,(Tamati et al., 2021)</p>						<p>Member Of Whānau</p> <ul style="list-style-type: none"> • Manawaroa (Persisting Despite Difficulty) • Piripono (Integrity, Commitment And Responsibility For A Shared Kaupapa) 			
<p>Promotion of physical activity in rural, remote and northern settings: a Canadian call to action,(Nykiforuk et al., 2018)</p>	-	-	28	≥18 years, 5-13 years, 12-18 years	-	-	<p>The text mentions that there is 1 study relevant to the rural setting, but it does not provide any information about the findings of that study</p>	<p>The potential limitations of the analysis were conflating terms used to categorize review articles, not accounting for data quality as an inclusion criterion, and not capturing relevant information reported at the study level</p>	<p>The text mentions to create opportunities to collaborate with community members, practitioners, and researchers living and working in rural, remote, and northern communities in policy development, implementation, and evaluation</p>
<p>Correlates Of Participation in Spots and Physical Activities Among</p>	Canada	cross sectional	4,790	between 12 and 17	-	<ul style="list-style-type: none"> • Participation In Sport And/Or Physical Activities (S/Pa) 	<p>What percentage of youth participated in sports and</p>	<p>What are some limitations of the study?</p>	<p>The question is not clear. Please provide a valid</p>

**Indigenous
Youth,(Wilk et al.,
2018)**

physical activities (S/PA)? 63.2% of youth participated in S/PA

The study has several limitations. 1st, the study employs a cross sectional design and therefore cannot infer any causal relationships. 2nd, due to the limited number of questions pertaining to S/PA in the APS survey, the activity levels of the youth who participated could not be adequately determined. Additionally, the variables currently available in the APS measurement tools do not allow for a direct measurement question related to the given text

of many of the broader contextual factors that affect various health related behaviours among Indigenous peoples. Finally, the information provided on youth activity levels was self or proxy reported, which may lend to reporting bias

<p>Health Benefits of Physical Activity: A Strengths-Based Approach, (Warburton & Bredin, 2019)</p>	-	-	-	-	-	-	-	-	-	-	-	<p>What are some of the health benefits associated with routine physical activity and/or exercise participation? Regular physical activity and/or exercise participation is thought to be of benefit for more than 25 chronic medical</p>	<p>The text mentions obesity as 1 of the challenges that can be addressed through physical activity and healthy lifestyle behaviors</p>	<p>The text mentions opportunities to enhance the health and wellbeing of children through physical activity and other healthy lifestyle behaviors</p>
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conditions.
There are well established dose response relationships between physical activity and health with consistent 20-30% risk reductions for premature mortality and several chronic medical conditions.
Larger risk reductions are generally observed when objective markers of aerobic fitness are considered. Routine physical activity was associated in dose dependent fashion with a reduced risk for diverse health outcomes (such as cardiovascular disease, all cause mortality, all

cancer mortality, type 2 diabetes, hypertension, breast cancer, colon cancer, gestational diabetes, gallstone disease, ischemic heart disease, ischemic stroke, and self reported health status). These health benefits appear to cover a wide range of medical conditions including mental health and wellness. Running participation was associated with a 27, 30, and 23%, respectively, reduced risk of all cause , cardiovascular , and cancer related mortality. Any physical activity (regardless of intensity) and

less time spent
being sedentary
were associated
in a dose
dependent
fashion with a
significantly
reduced risk for
premature
mortality
