UNIVERSIDADE
BEIRA INTERIOR

The influence of sport on the physical fitness, quality of life and well-being of people with intellectual and developmental disabilities

Susana Cristina Oliveira Diz

Tese para obtenção do Grau de Doutor em
Ciências do Desporto
(3º ciclo de estudos)

Orientador: Prof. Doutor Raúl de Sousa Nogueira Antunes
Co-orientador: Prof. Doutor Aldo Filipe Matos Moreira Carvalho da Costa

Novembro 2025

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19 de novembro de 2025

Declaração de Integridade

Eu, Susana Cristina Oliveira Diz, que abaixo assino, estudante com o número de inscrição D3377 de Ciências do Desporto da Faculdade de Ciências Sociais e Humanas, declaro ter desenvolvido o presente trabalho e elaborado o presente texto em total consonância com o **Código de Integridades da Universidade da Beira Interior**.

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Assinado por: **Susana Cristina Oliveira Diz**
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Dedication

To all participants who made it possible to implement the intervention programme of this thesis,

To all people with disabilities who do not yet have the opportunity to practise sport,

And to all professionals who, with daily dedication and passion, work to ensure that sport is accessible to all those who wish to practise it, with respect and dignity.

"Alone we can do so little, together we can do so much"

Helen Keller

Acknowledgements

“You learn that you can't achieve anything alone. In any field, in any endeavour, the people around you have to be good people and able to work together. That's where true joy comes from – when you're sharing success with someone else.”

- Gregg Popovich

I came across this quote thanks to my thesis supervisor and perfectly expresses how I feel as I conclude this stage: the awareness that none of this would have been possible alone. If I am submitting this thesis today, it is because I was surrounded by generous people who believed in me and in the process, who helped me and were there for me, people with who I had the privilege of sharing not only the effort, but also the joy of this achievement.

Firstly, I would like to express my sincere gratitude to my thesis supervisor, Professor Raúl Antunes. For his generosity and humility in sharing his knowledge, for his unconditional support, for the opportunities he encouraged me to embrace, but above all, for walking this path with me, ensuring that I never felt less capable or helpless. He taught me much more than technical and scientific skills, and perhaps no amount of gratitude is enough to repay his guidance and friendship over these three years.

To my co-supervisor, Professor Aldo Costa, I am grateful for his trust, help, sharing of knowledge, and immediate availability to clarify and resolve any issues. It was a privilege to have his support.

To my colleague Professor Miguel Jacinto, I cannot find the words to thank him for the generosity with which he always offered me his support and help, even when time was scarce.

To Professors Rui Matos, Diogo Monteiro and Nuno Amaro, I extend my gratitude for their teachings throughout this journey and for their attention and assistance in the development of various projects.

I would like to thank the University of Beira Interior for welcoming me and allowing me to pursue this academic path, for the availability of all the professionals and for the teachings provided throughout this cycle of studies. I would also like to thank the Polytechnic Institute of Leiria, in particular, to the Social Services Administrator, Ms. Cláudia Toneca, for her

kindness and competence, for believing in this project, but especially for the concern she shows for others. In addition, I would like to thank the school where I graduated, the School of Education and Social Sciences of the Polytechnic Institute of Leiria, for lending me the necessary materials for the project.

To the *Organização de Apoio e Solidariedade para a Integração Social* (OASIS), the *Cooperativa de Ensino e Reabilitação de Cidadãos Inadaptados de Leiria* (CerciLei), the participants and their families, my deepest thanks for the affection, support and trust placed in us. It was a real honour to share the pavilion with our participants, to have the opportunity to witness their achievements, to observe their enjoyment of practice and to feel their happiness and dedication every week. It is these little things that make us want to continue to do more and better, even if the path is not always easy. Thank you, so many times, without knowing it, you have been a fundamental support.

To my boyfriend, an essential pillar in my life, to my family and friends, thank you for always being by my side, for understanding my absence, respecting my time and encouraging me to continue. I know that, regardless of the difficulties, I will always have a hug to return to, and perhaps that is the best thing we have in life.

Finally, I would like to express my deepest gratitude to my mother. She is the best person I know, an example of humanity, strength, resilience, and empathy. These three years have not been easy, but at no point did I ever feel that I lacked her unconditional support. She always had time to give me advice or a comforting hug. Much of who I am today and what I have achieved in life, I owe to her, to her guidance, her resilience, her courage and generosity, but above all, to the unconditional love she has always given me. This victory is as much mine as it is hers.

My most sincere thanks to all these people who helped me achieve this goal and made the last three years a beautiful memory that I will always love to remember.

"Find a group of people who challenge and inspire you, spend a lot time with them, and it will change your life."

- Amy Poehler

Resumo

A presente tese de doutoramento consiste num projeto de investigação, dividido em seis estudos distintos e analisa as seguintes variáveis: desporto, qualidade de vida (QdV), bem-estar, aptidão física funcional e composição corporal em pessoas com dificuldade intelectual e desenvolvimental (DID).

Com a intenção de contextualizar a população em estudo, torna-se relevante referir que a DID é caraterizada por limitações no funcionamento intelectual e no comportamento adaptativo, que se expressam nos domínios conceptuais, práticos e sociais. Pode apresentar diferentes graus de severidade e expressar-se até aos 22 anos de idade.

Após uma breve introdução no capítulo um, o capítulo dois é composto por uma revisão sistemática (estudo 1 - *Physical Activity, Quality of Live and Well-Being in Individuals with Intellectual and Developmental Disability*) que pretende analisar o estado da arte sobre o papel da atividade física (AF), do exercício físico (EF) e do desporto na QdV e bem-estar das pessoas com DID. Para a realização da pesquisa, foram utilizadas três bases de dados bibliográficas (PubMed, Web of Science e Scopus) e quinze artigos que cumpriram os critérios de elegibilidade para o estudo. Após a analise dos artigos, foram identificados valores mais elevados na pontuação total da QdV e em alguns dos seus domínios (e.g., desenvolvimento pessoal, bem-estar físico e bem-estar emocional), na satisfação com a vida e na perceção de bem-estar em pessoas com DID que usufruíram ou usufruem de programas de AF, EF e/ou desportos.

No terceiro capítulo, pode ser encontrado um estudo transversal (estudo 2 - *Functional fitness and quality of life in people with intellectual and developmental disabilities: an exploratory study*) que visa analisar a aptidão física funcional e a QdV, assim como as associações entre estas variáveis, de um grupo amostral de 37 indivíduos com DID. Os resultados demonstram uma associação entre capacidades funcionais especificas e o bem-estar físico, sugerindo que a promoção destas competências pode influenciar positivamente o bem-estar físico da amostra.

A revisão narrativa (estudo 3 - *The use of control group in research design: the ethical challenge in the population with intellectual and developmental disabilities*), que corresponde ao quarto capítulo, aborda os desafios éticos na utilização de grupos de controlo em projetos de investigação. Nos estudos analisados sobre populações com DID, foi possível verificar que a maioria dos investigadores privilegia a utilização de grupos de controlo que, durante o período de investigação, não realizam qualquer atividade para além

das atividades habituais da sua vida quotidiana. Também foi possível verificar que, na sua maioria, os autores asseguram o seguimento das normas éticas em estudos com seres humanos.

O quinto capítulo, o protocolo de estudo (estudo 4 - *The Effects of a Multi-Sports Program on the Physical Fitness, Quality of Life, and Well-Being of People with Intellectual and Developmental Disabilities—A Study Protocol*), retrata o programa de intervenção, a ser implementado nos estudos experimentais, baseado na prática de modalidades desportivas para pessoas com DID, com o objetivo de analisar os seus efeitos na composição corporal, aptidão física funcional, QdV e bem-estar. No presente estudo é referido que a amostra, de conveniência, deverá ser constituída por pelo menos 24 participantes adultos, institucionalizados, com um diagnóstico prévio de DID e sem comorbilidades associadas (e.g., deficiência visual ou paralisia cerebral). Os participantes deverão ser divididos em dois grupos: experimental e controlo, sendo que o grupo experimental (GE) deverá usufruir de uma sessão semanal, com a duração de 60 minutos, durante 36 semanas.

O sexto capítulo e primeiro estudo de intervenção (estudo 5 - *The effect of practising sports on the quality of life and well-being of people with intellectual and developmental disabilities*), tem como objetivo analisar o efeito de uma intervenção baseada na prática de modalidades desportivas na QdV e no bem-estar de pessoas com DID. A amostra foi constituída por 36 participantes com DID, em contexto de instituição, divididos em dois grupos: o GE, composto por 23 participantes e o grupo de controlo (GC), com 13 indivíduos. Após o programa de intervenção, foram observadas melhorias significativas nos participantes do GE nos domínios da autodeterminação, inclusão social e bem-estar físico da QdV e na satisfação com a vida e afetos negativos. Por sua vez, o sétimo capítulo e último estudo (estudo 6 - *The effect of practising sports on the body composition and physical fitness of people with intellectual and developmental disabilities*), tem como objetivo analisar o efeito de uma intervenção baseada na prática de modalidades desportivas na composição corporal e aptidão física funcional de pessoas com DID. Após o programa de intervenção, foram observadas melhorias significativas nos participantes do GE (na comparação entre o momento pré-intervenção e o momento pós-intervenção) no índice de massa corporal (IMC), massa muscular, teste de sentar e levantar e 6 minutos a caminhar.

A presente investigação reforça a importância da prática de AF e desporto como veículo condutor para a melhoria da saúde, QdV, bem-estar e aptidão física das pessoas com DID. Apesar do estado da arte ainda ser limitado, é notório o crescente interesse pela área do desporto para pessoas com deficiência e dos seus benefícios. Nesse sentido, é cada vez

mais evidente a importância da integração deste tipo de intervenções em contextos institucionais e comunitários. Assim, é essencial que os técnicos de exercício físico, as instituições de apoio a esta população e as autarquias locais contribuam ativamente para a implementação de projetos desta natureza e desenvolvam, em conjunto, as melhores estratégias para garantir a continuidade na prática.

Palavras-chave

Dificuldade intelectual e desenvolvimental;desporto;qualidade de vida;bem-estar;aptidão física;composição corporal

Resumo Alargado

A DID é caraterizada por limitações no funcionamento intelectual e no comportamento adaptativo, que se expressam nos domínios conceptuais, práticos e socias. É uma perturbação do desenvolvimento, que se manifesta até aos 22 anos de idade e pode apresentar diferentes graus de severidade. A adicionar, as pessoas com DID tendem a apresentar comorbilidades (e.g., obesidade, hipertensão, doenças cardiovasculares), muitas vezes associadas ao estilo de vida sedentário que, tendencialmente, apresentam.

Diferentes estudos têm evidenciado o impacto positivo que a prática regular de AF, EF e desporto podem ter no controlo de doenças crónicas, na aptidão física funcional, QdV e bem-estar desta população. No entanto, apesar dos benefícios, as pessoas com DID continuam a apresentar, de forma geral, um estilo de vida sedentário. Este comportamento está associado, entre outros fatores, à reduzida oferta e curta duração dos programas de intervenção, à falta de apoio por parte da comunidade e de técnicos especializados, bem como fatores motivacionais.

Neste sentido, torna-se necessário dar resposta às barreiras apresentadas através da implementação de intervenções eficazes, sustentadas no tempo, dirigidas por profissionais especializados que atendam às necessidades, interesses e motivações das pessoas com DID.

A presente tese tem como principal objetivo compreender a influência da prática AF, EF e modalidades desportivas na QdV e bem-estar desta população, bem como desenvolver, implementar e analisar os efeitos de um programa de intervenção, baseado na prática de modalidades desportivas na aptidão física funcional, composição corporal, QdV e bem-estar de pessoas DID. Estruturada em seis estudos, a presente tese inclui uma revisão sistemática, um estudo transversal, uma revisão narrativa, um protocolo de intervenção e dois estudos experimentais.

No capítulo II (estudo 1 - *Physical Activity, Quality of Live and Well-Being in Individuals with Intellectual and Developmental Disability*) é apresentada uma revisão sistemática, que pretende analisar a literatura existente relativamente ao papel da AF, EF e desporto na QdV e no bem-estar de pessoas com DID. A pesquisa foi realizada em bases de dados bibliográficas, PubMed, Web of Science e Scopus, selecionando quinze artigos que cumpriram os critérios de inclusão definidos. Todos os artigos foram avaliados através da escala *Downs and Black*, não tendo sido excluído nenhum. A análise realizada aos estudos sugere que a prática de AF, EF e desporto pode contribuir para a melhoria da QdV e bem-estar das pessoas com DID. Adicionalmente, a revisão sistemática permitiu identificar uma

lacuna importante na literatura no que respeita à prescrição e avaliação de programas baseados na prática de modalidades desportivas.

O III capítulo (estudo 2 - *Functional fitness and quality of life in people with intellectual and developmental disabilities: an exploratory study*) compreende um estudo transversal que tem como objetivo analisar a aptidão física funcional e a QdV numa amostra de pessoas com DID, bem como as associações entre estas variáveis. A amostra, composta por 37 indivíduos com DID, realizou os testes de levantar e sentar na cadeira, *timed up and go* e caminhar durante 6 minutos, para avaliar a aptidão física funcional e a *Personal Outcome Scale*, para avaliar o bem-estar físico. Os resultados sugerem que a força dos membros inferiores e a capacidade cardiorrespiratória estão associadas ao bem-estar físico, reforçando a importância da promoção de programas de AF, EF e desporto para a melhoria da QdV e bem-estar desta população.

A revisão narrativa (estudo 3 - *The use of control group in research design: the ethical challenge in the population with intellectual and developmental disabilities*) apresentada no IV capítulo, tem como objetivo analisar os desafios éticos no uso de GC em projetos de investigação. Nos estudos analisados, com pessoas com DID, o uso de GC que, durante o período de investigação, não se envolve em nenhuma atividade para além das atividades da vida diária habituais é o mais utilizado. No entanto, a revisão destaca a importância ética de assegurar que os participantes do GC tenham, após o término da investigação, a oportunidade de usufruir da mesma intervenção aplicada ao GE. Em suma, a presente revisão narrativa sublinha a necessidade de conciliar o rigor científico com a proteção e respeito pelos participantes, fornecendo diretrizes importantes para a condução ética de estudos experimentais.

Com base nas evidências recolhidas e nas limitações identificadas, foi desenvolvido um protocolo de estudo, apresentado no V capítulo (estudo 4 - *The Effects of a Multi-Sports Program on the Physical Fitness, Quality of Life, and Well-Being of People with Intellectual and Developmental Disabilities—A Study Protocol*). O protocolo de estudo contempla o programa de intervenção a ser implementado nos estudos experimentais. Faz referência à amostra, de conveniência, indicando que a mesma deverá ser composta por pelo menos 24 participantes, com idades compreendidas entre 18 e 65 anos, de ambos os sexos, em contexto de instituição, com diagnóstico prévio de DID e sem comorbidades associadas (e.g., deficiência auditiva, deficiência visual). Refere, também, a divisão dos participantes em dois grupos, o GE e o GC, sendo que o GE usufruirá de uma sessão semanal, baseada na prática de modalidades desportivas, com duração de 60 minutos, durante 36 semanas. Serão realizadas três avaliações (avaliação inicial, avaliação final e

avaliação de acompanhamento) com o objetivo de analisar a influência do programa de intervenção na aptidão física funcional, composição corporal, QdV e bem-estar dos participantes.

Os dois estudos experimentais têm como objetivo analisar o impacto do programa de intervenção na aptidão física, composição corporal, QdV e bem-estar de pessoas com DID em contexto de instituição. Com uma amostra composta por 36 participantes, divididos em dois grupos, o GE (n=23) e o GC (n=13), o VI capítulo (estudo 5 - *The effect of practising sports on the quality of life and well-being of people with intellectual and developmental disabilities*) aborda a influência do programa de intervenção na QdV e bem-estar. Os resultados alcançados indicam melhorias estatisticamente significativas para o GE nos domínios da autodeterminação, inclusão social, bem-estar físico e bem-estar emocional, da QdV e na satisfação com a vida, afetos positivos e negativos, do bem-estar. Estes resultados destacam o impacto positivo que um programa de intervenção baseado em modalidades desportivas, com duração de 36 semanas, ajustado às necessidades e interesses dos indivíduos e implementado de forma regular, parece ter na QdV e no bem-estar dos participantes. O VII capítulo (estudo 6 - *The effect of practising sports on the body composition and physical fitness of people with intellectual and developmental disabilities*) explora a influência do programa de intervenção na aptidão física funcional e composição corporal. Os resultados alcançados revelam melhorias estatisticamente significativas no GE, para o índice de massa corporal, massa muscular, força e resistência dos membros inferiores, e capacidade cardiorrespiratória. Relativamente ao GC, na comparação entre o momento pré e o momento pós intervenção, os resultados reportam diferenças estatisticamente significativas no teste de preensão manual, com a mão direita, sugerindo um decréscimo na performance. Além dos benefícios verificados na aptidão física funcional, composição corporal, QdV e bem-estar, os participantes manifestaram um elevado nível de satisfação com o programa de intervenção, evidenciando a importância de adequar as intervenções aos interesses e necessidades da população com DID, fator que pode contribuir para uma adesão e permanência superiores às reportadas na literatura.

No capítulo VIII, o último, é apresentada uma conclusão geral da tese, onde são abordadas as principais conclusões e suas implicações práticas, bem como as limitações e sugestões para pesquisas futuras.

Palavras-Chave

Dificuldade intelectual e desenvolvimental;desporto;qualidade de vida;bem-estar;aptidão física;composição corporal

Abstract

This PhD thesis consists of a research project divided into six separate studies and looks at the following variables: sport, quality of life (QoL), well-being, functional physical fitness, and body composition in people with intellectual and developmental disabilities (IDD).

In order to contextualise the study population, it is important to note that IDD is characterised by limitations in intellectual functioning and adaptive behaviour, which are expressed in conceptual, practical and social domains. It can present different degrees of severity and manifest itself up to the age of 22.

After a brief introduction in chapter one, chapter two consists of a systematic review (study 1 - Physical Activity, Quality of Life and Well-Being in Individuals with Intellectual and Developmental Disability), which aims to analyse the state of the art on the role of physical activity (PA), physical exercise (PE) and sport in QoL and well-being in people with IDD. Three databases were used to conduct the research: PubMed, Web of Science and Scopus, and fifteen articles met the eligibility criteria for the study. After analysing the articles, higher values were identified in the total QoL score and in some of its domains (e.g., personal development, physical well-being and emotional well-being), in life satisfaction and in the perception of well-being in people with IDD who have benefited or benefit from PA, PE and/or sports programmes.

The third chapter contains a cross-sectional study (study 2 - Functional fitness and quality of life in people with intellectual and developmental disabilities: an exploratory study) that aims to analyse functional physical fitness and QoL, as well as the associations between these variables, in a sample population with IDD, composed of 37 individuals. The results demonstrate an association between specific functional abilities and physical well-being, suggesting that promoting these skills can positively influence the physical well-being of the sample.

The narrative review (study 3 - The use of control groups in research design: the ethical challenge in the population with intellectual and developmental disabilities), which corresponds to the fourth chapter, addresses the ethical challenges in the use of control groups in research projects. In the studies analysed on populations with IDD, it was possible to verify that most researchers favour the use of control groups that, during the research period, do not perform any activities beyond their usual daily activities. It was also possible

to verify that, for the most part, the authors ensure compliance with ethical standards in studies involving human subjects.

The fifth chapter, the study protocol (study 4 - The Effects of a Multi-Sports Programme on the Physical Fitness, Quality of Life, and Well-Being of People with Intellectual and Developmental Disabilities—A Study Protocol), describes the intervention programme to be implemented in the experimental studies, based on the practice of sports for people with IDD, with the aim of analysing its effects on body composition, functional physical fitness, QoL, and well-being. In the present study, it is stated that the convenience sample should consist of at least 24 adult participants, institutionalised, with a previous diagnosis of IDD and no associated comorbidities (e.g., visual impairment or cerebral palsy). Participants will be divided into two groups: experimental and control, with the experimental group (EG) enjoying a weekly 60-minute session for 36 weeks.

The sixth chapter and first intervention study (study 5 - The effect of practising sports on the quality of life and well-being of people with intellectual and developmental disabilities) aims to analyse the effect of an intervention based on practising sports on the QoL and well-being of people with IDD. The sample consisted of 36 participants with IDD in an institutional setting, divided into two groups: the EG, composed of 23 participants, and the control group (CG), with 13 individuals. After the intervention programme, significant improvements were observed in the EG participants in the domains of self-determination, social inclusion and physical well-being of QoL, as well as in life satisfaction and negative affect. In turn, the seventh and final study (study 6 - The effect of practising sports on the body composition and physical fitness of people with intellectual and developmental disabilities) aims to analyse the effect of an intervention based on the practice of sports on the body composition and functional physical fitness of people with IDD. After the intervention programme, significant improvements were observed in the comparison between the pre-intervention and post-intervention moments in the participants of the EG in body mass index (BMI), muscle mass, sit-to-stand test and 6-minute walk test.

This research reinforces the importance of PA and sports as a vehicle for improving the health, QoL, well-being, and physical fitness of people with IDD. Although still scarce, there is a growing interest in sports for people with disabilities and their benefits. In this sense, the importance of integrating this type of intervention into institutional and community contexts is increasingly evident. It is therefore essential that exercise technicians, institutions and local authorities actively contribute to the implementation of projects of this nature and, equally important, to their continuity over time.

Keywords

Intellectual and developmental disability;sport;quality of life;well-being;physical fitness;body composition

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List of Abbreviations

IDD	Intellectual and Developmental Disability
AAIDD	*American Association on Intellectual and Developmental Disabilities*
WHO	*World Healthy Organization*
PA	Physical Activity
PE	Physical Exercise
QoL	Quality of Life
IQ	Intelligence quotient
CG	Control Group
EG	Experimental Group
BMI	Body Mass Index
TUG	Timed Up and Go

List of publications

This PhD thesis includes the following articles:

Study 1: Diz, S., Jacinto, M., Costa, A., Monteiro, D., Matos, R. &Antunes, R. (2024). Physical Activity, Quality of Live and Well-Being in Individuals with Intellectual and Developmental Disability. *Healthcare,* 12(6), 654. http://dx.doi.org/10.3390/healthcare12060654

Study 2: Diz, S., Jacinto, M., Monteiro, D., Matos, R., Garrido, N., Costa, A. & Antunes, R. (2024). Functional fitness and quality of life in people with intellectual and developmental disabilities: an exploratory study. *Motricidade, 20*(2), 174-180. https://doi.org/10.6063/motricidade.33482

Study 3: Diz, S., Jacinto, M., Monteiro, D., Matos, R., Esteves, D., Costa, A. & Antunes, R. (2024). The use of control group in research design: the ethical challenge in the population with intellectual and developmental disabilities. *Motricidade, 20*(4), 359 -365. https://doi.org/10.6063/motricidade.30653

Study 4: Diz, S., Costa, A., Jacinto, M., Monteiro, D., Amaro, N., Rodrigues, F., Matos, R. & Antunes, R. (2024). "The Effects of a Multi-Sports Program on the Physical Fitness, Quality of Life, and Well-Being of People with Intellectual and Developmental Disabilities—A Study Protocol". *Disabilities,* 4, 741-753. http://dx.doi.org/10.3390/disabilities4040045

Study 5: Diz, S., Jacinto, M., Costa, A. M., Matos, R., & Antunes, R. (2025). The effect of practising sports on the quality of life and well-being of people with intellectual and developmental disabilities. *International Journal of Developmental Disabilities*, 1–13. https://doi.org/10.1080/20473869.2025.2511674

Study 6: Diz, S., Jacinto, M., Costa, A., Matos, R., Monteiro, D., Teixeira, J. & Antunes, R. (Under Review). The effect of practising sports on the body composition and physical fitness of people with intellectual and developmental disabilities. *Frontiers in Psychology*

Chapter 1 – Introduction

1.1. Contextualisation of the topics

In 2007, the American Association on Mental Retardation (AAMR) changed its name to the American Association on Intellectual and Developmental Disabilities (AAIDD), replacing the term “mental disability” with “intellectual and developmental disability” (IDD) (Morato & Santos, 2007). This recent terminology is considered less offensive and more respectful of people's dignity, promoting a sense of equality among citizens (Schalock et al., 2007). One of the main differences between the concepts of mental disability and IDD lies in their focus, while the first centres on limitations in intellectual functioning, the second emphasises the interaction between the individual and different life contexts, considering the support received as fundamental elements for promoting functionality (Morato & Santos, 2007).

This change in terminology also seeks, in addition to mitigating the negative labelling imposed by previous terminologies, to reduce stigma and, through appropriate support, promote development and remove barriers that citizens may encounter throughout their lives, favouring their autonomy (Silva & Coelho, 2014). For Morato and Santos (2007), the use of the term “difficulty” has a more positive, less stigmatising connotation, making it more appropriate and fairer. Similarly, the term “intellectual” is more concrete and comprehensive in functional terms (Morato and Santos, 2007).

IDD is thus a developmental disability that originates during an individual's developmental period, up to the age of 22. It is characterised by limitations in adaptive behaviour and intellectual functioning, which are expressed in conceptual, practical and social domains, with varying degrees of severity: mild, moderate, severe or profound (Schalock et al., 2021).

Intellectual functioning is a broad concept that encompasses how a person thinks, learns, solves problems and understands the world around them. It includes different abilities assessed through intelligence quotient (IQ) tests, but also considers the influence of other dimensions of human functioning and available support (Schalock et al., 2021). Adaptive behaviour, in turn, is the set of conceptual, practical and social skills that people learn and apply in their daily lives (Schalock et al., 2021). Conceptual skills are related to communication, orientation and mastery of time or numbers. Practical skills include daily activities, routines, financial management, among others. Social skills relate to compliance

with rules, self-esteem and social responsibility (Schalock et al., 2021). Thus, adaptive behaviour develops and tends to increase in complexity throughout life. It is related to age expectations and demands in specific contexts and is assessed through the person's typical performance in different contexts (e.g., home, school, leisure) (Schalock et al., 2010).

Despite not being included in the diagnostic criteria, people with IDD tend to have difficulties with motor performance, specifically limitations in mobility (e.g., Cleaver et al., 2009), sensory deficits, and slower and less accurate motor responses (Carmeli et al., 2008; Pitteti & Yarmer, 2002). These factors compromise their autonomy in activities of daily living and social participation (Enkelaar et al., 2013). In addition, this population tends to have a sedentary lifestyle (Dairo et al., 2016; Harris et al., 2019) associated with low levels of physical activity (PA) (Pierce and Maher 2020; Bossink et al. 2017).

These behaviours place people with IDD in a situation of greater vulnerability, with an increased risk of developing different comorbidities, such as overweight/obesity, type II diabetes, hypertension, cardiovascular diseases (O'Leary et al., 2018; Bartlo and Klein, 2011; Calders et al., 2011) and, consequently, early death (O'Leary et al., 2018). In addition to the above, reduced levels of PA and sedentary lifestyles contribute to low levels of physical fitness, namely reduced levels of strength, aerobic capacity, balance and flexibility (Chow et al., 2018; Wouters et al., 2017) with negative consequences for gait (Cleaver et al., 2009), postural control (Lahtinen et al., 2007), object manipulation (Enkelaar et al., 2013) and, consequently, success in performing activities of daily living (Oppewal et al., 2014). Decreased muscle strength, especially in the lower limbs, is closely associated with a decline in physical and functional capacity (Silva et al., 2017; Mendonça et al., 2013).

In this context, motor difficulties, a tendency towards a sedentary lifestyle and comorbidities associated with people with IDD not only affect physical and functional capacity, but also have direct repercussions on the perception of quality of life (QoL) and well-being.

The concept of QoL initially emerged as a relevant complement to traditional concepts of health and functional status (WHOQDV GROUP, 1998). For the World Health Organisation (WHO), QoL refers to each person's perception of their position in life, considering the context, culture and value system in which they live. This perception is influenced by each person's personal goals, expectations, standards and concerns. This multidimensional concept was validated based on seven main domains: physical health; psychological well-being; independence; social relationships; environment; spirituality; and personal domain (WHOQDV GROUP, 1994; 1998). For Schalock et al. (2002), QoL is a set of factors that determine an individual's state of well-being, which can be influenced by

personal characteristics and environmental factors that change over time (Schalock et al., 2010). The model proposed by Schalook et al. (2011) consists of a multidimensional approach to QoL, composed of domains and factors that, although the same for all people, may differ in terms of value and importance (Schalock et al., 2011). Thus, the conceptual model of QoL in IDD covers eight domains that give rise to three factors: independence, participation, and well-being (Simões et al., 2016; Schalock and Verdugo, 2002). The domains 'Personal Development' and 'Self-determination' belong to the factor 'Independence'. 'Interpersonal Relationships', 'Social Inclusion' and "Rights" correspond to the factor 'Social Participation'. Finally, the domains 'Emotional Well-being,' 'Physical Well-being,' and 'Material Well-being' belong to the factor 'Well-being' (Simões et al., 2016; Schalock and Verdugo, 2002).

The assessment of QoL in IDD allows us to measure the degree of satisfaction of individuals with their own lives, evaluate interventions and theoretical models, and guide personalised support practices (Schalock and Verdugo, 2002). In addition to the above, assessing QoL allows us to understand the challenges and barriers that individuals have faced, contributing to their resolution and improvement of public policies or service practices in order to meet their needs and choices (Jacinto et al., 2023).

Well-being, one of the factors in the QoL model presented above, can be analysed from two distinct but complementary perspectives: objective well-being and subjective well-being (Ryff et al., 2021). Subjective well-being corresponds to an individual's perception of their own life (Kashdan et al., 2008), including personal satisfaction, the pursuit of pleasure and the rejection of suffering (Ryan & Deci, 2001). It encompasses the cognitive (life satisfaction) and emotional (affects) evaluations that a person makes about their own life (Diener, 2009) and is considered a long-term state that comprises these two dimensions (Diener et al., 1985). The concept of affect comprises two relatively independent dimensions (Tellegen et al., 1999, Watson, et al., 1988), positive affect, which reflects the degree to which a person feels enthusiastic, active, and alert. And negative affect, which comprises the degree to which a person feels distressed and without feelings of pleasure (Albuquerque & Troccóli, 2004; Diener et al., 2003; Diener et al., 2002). In turn, life satisfaction is related to the satisfaction a person feels with life in general or specifically in different domains (e.g., health, future security, and relationships) (Diener et al., 2002), and is also associated with the social and economic resources available to them (Cummins, 2002; Cummins, 2005). This judgement depends on a comparison between current circumstances and what the subject defines as an adequate standard (Diener, et al., 1985; Pavot & Diener, 2008).

Scientific evidence has highlighted the positive impact of regular PA, PE and sports practice on the QoL and well-being of this population (Franco et al., 2023; Moltó and Bruna, 2017; Lante et al., 2014; Pestana et al., 2018), as well as the benefits in the prevention and control of various chronic diseases (e.g., Bartlo & Klein, 2011; Calders et al., 2011). Similarly, improvements in physical fitness have been evidenced, namely in lower limb strength, cardiorespiratory capacity (e.g.: Jacinto et al., 2023; Obrusnikova et al., 2022; Diz et al., 2021; Kocić et al., 2017) and body composition (Jacinto et al., 2023; Yu & Hong, 2023; Obrusnikova et al., 2021).

However, despite all the documented benefits, people with IDD continue to lead predominantly sedentary lifestyles. This scenario is due, among other factors, to the existence of barriers that prevent or hinder the practice of PA, PE and sport by this population. These include the short duration of intervention programmes, the limited availability of activities, the lack of community support, motivational factors and the need for specialised technicians (Jacinto et al., 2021; McGarty and Melville; 2018; Bossink et al., 2017). In this sense, it is necessary to develop effective interventions that aim to address the barriers presented and that, at the same time, are adjusted to the interests, motivations, and needs of this population.

Although research on the practice of sports in people with IDD is still limited (Diz et al., 2024a), studies conducted with other populations (e.g., the elderly, visually impaired) reveal similar benefits (Ilhan et al., 2021; Diaz et al., 2019; Pedersen et al., 2017). Therefore, it is important to understand how the practice of sports can contribute to improving functional physical fitness, body composition, QoL and well-being in people with IDD, thus justifying the relevance of the present study.

1.2. General Objetives

This thesis aims to understand the influence of PA, PE and sports on the QoL and well-being of people with IDD, but also to develop and implement an intervention programme based on sports and analyse its effects on the aforementioned variables (QoL and well-being), as well as on the functional physical fitness and body composition of people with IDD in an institutional context.

Considering the barriers that prevent or hinder the practice of PA, PE and sports by people with IDD, as well as the reduced participation of this population in intervention programmes of this nature, this programme aims, in addition to the objective mentioned

above, to provide an effective response to some of the difficulties identified, giving priority to the interests and needs of the participants, as well as their opinion on the sessions, promoting continuous involvement.

1.3. Organisation of the thesis

After a brief introduction (chapter 1), chapter 2 aimed to provide an update on the influence of PA, PE and sport on QoL and well-being in people with IDD. This chapter consists of a systematic review that analyses the state of the art on the role of these practices in promoting QoL and well-being in this population.

Considering the results obtained in the systematic review, it became pertinent, in chapter 3, to develop a cross-sectional study with the aim of analysing the functional physical fitness and QoL of a group of people with IDD in an institutional context, as well as to understand how these variables are associated. The results show a positive association between functional capacities (lower limb strength and cardiorespiratory capacity) and physical well-being, suggesting that the promotion of these skills may be positively associated with higher levels of physical well-being in this population.

Similarly, in order to properly address ethical issues in the intervention protocol, it was considered pertinent to conduct a narrative review (chapter 4) focusing on the ethical challenges associated with the use of control groups (CG) in research projects. In this review, it was found that it is common to use CG that, during the intervention period, do not perform any activities beyond their usual daily activities. These results are in line with the methodological design planned for the intervention programme in this thesis. It should be noted that, within the context of this research, the CG was offered the opportunity to participate in the same intervention programme carried out by the experimental group (EG) after the study was completed.

After gathering the information considered necessary for the development of the intervention programme – namely through a systematic review that contributed to the identification of relevant aspects for a better understanding of the evaluation and prescription of programmes, despite the scarcity of studies focused on the practice of sports – a study protocol was developed, presented in chapter 5. This chapter describes in detail all the steps to be followed in the intervention programme, including the prescription and procedures to be adopted at the time of evaluation, ensuring its replicability.

Taking into account chapter 5, a sample of people with IDD in an institutional setting was recruited and assessed to carry out the intervention programme, based on sports activities, for 36 weeks, with weekly sessions lasting 60 minutes. In Chapter 6, we present the results of the influence of the intervention programme on the QoL and well-being of the study population. In turn, Chapter 7 presents the results of the impact of the intervention programme on body composition and functional physical fitness.

Finally, Chapter 8 presents a general conclusion of the thesis, discussing the main conclusions and their practical implications, as well as the limitations of this thesis and suggestions for future research.

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Chapter 2 – Study I: Physical Activity, Quality of Live and Well-Being in Individuals with Intellectual and Developmental Disability

Diz, S., Jacinto, M., Costa, A., Monteiro, D., Matos, R. & Antunes, R. (2024). Physical Activity, Quality of Live and Well-Being in Individuals with Intellectual and Developmental Disability. *Healthcare,* 12(6), 654. http://dx.doi.org/10.3390/healthcare12060654

2.1. Abstract

The practice of physical activity, exercise and sport has many benefits for the general population, but studies on the population with IDD are scarce and inconclusive. The aim of this systematic review is to analyse the state of the art on the role of physical activity, exercise and sport in the quality of life and well-being of people with IDD, seeking to understand the current panorama in this area and provide answers to these questions. The research was carried out between July and October 2023 using three databases: PubMed, Web of Science and Scopus. Fifteen articles met the eligibility criteria for this study, and these were methodologically assessed using the Downs and Black scale (1998). Higher values were identified in the total quality of life score and some domains of this variable (e.g., personal development, physical well-being and emotional well-being), in satisfaction with life and in the perception of well-being in individuals with IDD who have enjoyed or are involved in physical activity, physical exercise and/or sports programs. Thus, according to the studies included in this systematic review, we can conclude that the practice of physical activity, physical exercise and sport seems to contribute to improving the quality of life and well-being of people with IDD. Despite the growing research interest in this area, there is still a notable lack of studies exploring the impact of these programs, especially sports-based programs, on quality of life and well-being variables in the population under study.

Keywords: physical activity; physical exercise; sport; quality of life; well-being; intellectual and developmental disability

2.2. Introduction

IDD is a developmental disorder that originates during the individual's developmental period, up to the age of 22. It is characterised by limitations in adaptive behaviour and intellectual functioning, which are expressed in the conceptual, practical and social domains (Schalock et al., 2021) with different degrees of severity, including mild, moderate, severe or profound. People with IDD tend to have difficulties in executive functioning (R Rodrigues et al., 2019) and psychomotor functioning, which affect their performance in activities of daily living and social participation (Santos, 2020), with mobility limitations (Cleaver et al., 2009) resulting from lower tonic and muscular performance, associated with sensory deficits and less precise and slower motor responses (Carmeli et al., 2008; Pitetti & Yarmer, 2002).

This population usually has a sedentary lifestyle (Bartlo & Klein, 2011), with low levels of PA (Bossink et al., 2017; Garavand et al., 2018; Pierce & Ma-her, 2020), which tends to negatively affect their QoL (Cabeza-Ruiz et al., 2020). Research has highlighted the positive impact of PA and PE in preventing diseases such as type II diabetes, hypertension and obesity (Bartlo & Klein, 2011; Calders et al., 2011), as well as their contribution to improving physical fit-ness, with benefits for the individual's general state of health, QoL and average life expectancy (Apolone & Mosconi, 2007; Jacinto et al., 2023). In this sense, different studies have shown that the practice of PA (Bartlo & Klein, 2011; Diz et al., 2021), PE (Carmeli et al., 2005, 2008) and sport (Crawford et al., 2015; García Moltó & Ovejero Bruna, 2017) seems to be associated with an improvement in the perception of well-being and QoL of adults with IDD. It is also possible to verify that higher levels of functional capacity seem to contribute to higher QoL values (Williams et al., 2021).

The QoL of people with IDD is defined as a person's perception of their position in life, their goals, standards, cultural and personal values and expectations in a variety of dimensions (World Health Organization Quality of Life Group [WHOQOL Group], 1997), and is influenced by personal characteristics and environmental factors that change over time (Schalock et al., 2011). Like QoL, well-being is also a complex concept which can be analysed from two different but complementary perspectives—objective and subjective well-being (Ryff et al., 2021). Specifically, subjective well-being income-passes the cognitive (life satisfaction) and emotional (affect) evaluations a person makes about their life (Diener, 2009), and is considered a long-term state that comprises these two dimensions (Diener et al., 1985). With regard to affect, its concept has two relatively independent dimensions (Tellegen et al., 1999; Watson et al., 1988): positive affect, reflecting the extent to which a person feels enthusiastic, active and alert, and negative affect, reflecting the extent to which a person feels distressed and lacks feelings of pleasure.

In turn, the concept of life satisfaction is related to the satisfaction a person feels with life, in general or specifically in different domains (e.g., health, future security and relationships) (Diener et al., 2002), and is also associated with the social and economic resources they have (Cummins, 2005; Cummins & Nistico, 2002). This judgement de-pends on the comparison between current circumstances and what the subject defines as an appropriate standard (Diener et al., 1985; Pavot & Diener, 2008).

Nowadays, maintaining or improving QoL and well-being is seen as a universal goal throughout the life of individuals with IDD, requiring the identification or development of facilitating tools and strategies (Schalock et al., 2021). Although several systematic reviews show that the practice of PA, PE or sport improves these variables in the adult and elderly

population without disabilities (Jacob et al., 2023; Wei et al., 2022), studies in the population with IDD are scarce and inconclusive. The study by Carmeli et al. (Carmeli et al., 2009) examining anxiety and QoL assessments revealed a 50% enhancement in the exercise intervention group, a 38% amelioration in the leisure activity group, and no improvement in the control group, providing indication that these variables may be related.

Thus, the aim of this systematic review is to analyse the state of the art on the role of PA, PE and sport in the QoL and well-being of people with IDD, seeking to understand the current panorama in this area and provide answers to these questions.

2.3. Materials and Methods

The present systematic review was performed according to the PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) protocol (Page et al., 2021) and the methods suggested by Bento and collaborators (Bento, 2014). The protocol was registered in PROSPERO, with the number CRD42023446863.

The PICOS strategy (Methley et al., 2014) was used to obtain a final sample of studies that included (i) a “P” (Patients) population with intellectual developmental disabilities, of any age, gender, ethnicity or race; (ii) an “I” (Intervention) corresponding to the sample practicing physical activity/physical exercise/sport or having been exposed to an intervention of the same nature and an assessment regarding their quality of life and/or well-being; (iii) a “C” (Comparison) corresponding to comparison between groups; iv) an “O” (Outcome) corresponding to levels of quality of life and well-being; and (v) an “S” (Study design) corresponding to cross-sectional studies, pilot studies and intervention studies, randomized controlled trials (RCTs) and non-RCTs.

2.3.1. Information Sources and Research Strategies

The systematic search for articles was conducted between July and October 2023, in English, in three electronic databases: PubMed, Web of Science and Scopus (title, abstract and keywords).

The following indexed search descriptors were used across all databases in the following formats: (“mental retardation” or “intellectual disability” or “intellectual and developmental disability” or “Intellectual Disabilities”) AND (“quality of life” or “wellbeing” or “well-being”).

2.3.2. Eligibility Criteria

The inclusion criteria considered for the selection of studies were as follows: (i) cross-sectional studies, pilot studies and intervention studies, RCTs and non-RCTs.; (ii) no restrictions on age or gender; (iii) no limitations on ethnicity or race; (iv) no re-strictions on the total number of participants; (v) no limitations regarding the duration, intensity, volume and frequency of programs; and (vi) studies that reported results on the effects of PA, PE or sports on QoL and or well-being. The primary exclusion criteria were as follows: (i) literature or narrative review articles, comments, or abstracts published in conference or congress proceedings; and (ii) studies in which QoL or well-being was not assessed.

2.3.3. Selection and Data Collection Process

The eligibility criteria were defined by all authors. The selected studies were reviewed in their entirety by two independent reviewers (SD and MJ), considering the eligibility criteria. The results obtained were compared and discussed to reach an agreement. When consensus was not possible, a third researcher was invited to collaborate (RA). Duplicate articles and all articles that did not meet the eligibility criteria were excluded. In the second phase, the full text was read, and the studies were selected for final analysis. After extraction, study information was described and structured in a table, namely authorship, year of publication, country, objectives, participants, duration/frequency, exercise/intensity, measurements, results, and methodology quality.

2.4. Results

2.4.1. Selection of Studies

The initial search, carried out in the three databases mentioned above, resulted in a total of 9178 articles. In the first phase, after removing duplicate articles, 6135 articles remained to be analysed in the following phases. After reading the titles and abstracts, 6005 articles were excluded, and 130 potentially relevant articles were identified for the following analysis. Considering the previously defined inclusion and exclusion criteria, after reading the articles in full, a sample of 15 articles were considered for complete analysis (Figure 1).

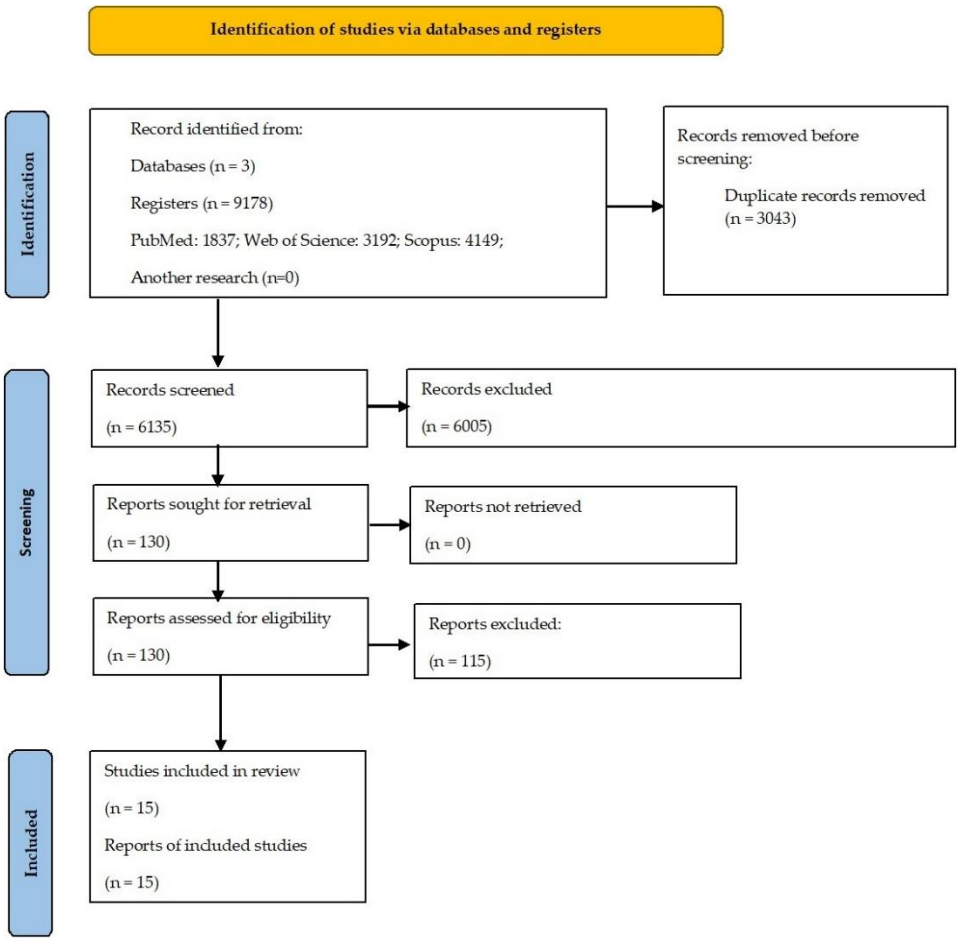

Figure 1 - PRISMA flow diagram illustrating each phase of the search and selecting process

2.4.2. Methodological Quality

The Downs and Black Scale (Downs & Black, 1998) were used to assess the methodological quality of the studies. The scale consists of 27 items that characterize the different parts of an article. Each item has four possible answers: "yes" (one point), "no" (zero points), "does not apply" and "unable to determine" (zero points). The methodological quality of the studies was assessed independently by two researchers (SD and MJ). The results obtained were compared and discussed in order to reach a consensus. When this consensus was not possible, a third researcher was invited to collaborate (RA).

One of the questions (item 27) from the scale was removed because it was not applied to all the studies analysed. In this way, the scale had a total of 26 questions. The methodological quality of the studies was between "Good" and "Poor"; however, no study was excluded due to its methodological quality. This classification is presented in Table 1.

Table 1 - Characteristics, results, and methodological quality of each of the studies included in the present review

Studies	Aims	Participants	Duration/Frequency	Exercise/Intensity	Measurements	Results	Methodology Quality
Barnet-Lopez et al. (2016) Spain, Europe	To analyse changes in the emotional well-being of adults with IDD after 26 sessions of dance/movement therapy.	N = 42 (male = 24; female = 18); 19–66 years old; moderate to severe IDD. Convenience sample. Randomized groups: EG (N = 22) and CG (N = 20). No sample size calculation.	3 months; 2× a week; 60 min/session.	Session phases: check-in, warm-up, transition-process and check out. Components and elements of the activities: body scheme, rhythms, self-concept, relationship, identification of the different types of emotions, Laban effort, balance and coordination, grounding and free dance.	Emotional well-being—Human Figure Drawing Test (HFD)	Experimental group (pre vs. post intervention): 5.55 ± 3.648 vs. 4.05 ± 3.258. Control group (pre vs. post intervention): 4.30 ± 0.669 vs. 4.50 ± 0.686. Significant differences between pre-test and post-test for the EG (p = 0.007) and no significant differences for the CG (p = 0.560). The emotional indicators are reduced in 13 participants from the EG, while in the CG, there were only 6 participants with reduced emotional indicators. Five emotional items increased their frequency after the program and fourteen emotional items decreased their	Fair

					frequency after the program, showing improvement.	
Bowers et al. (2016) Irland, Europe	To examine the experiences and perspectives of people with IDD, their families and staff who work with them about the Special Olympics on the island of Ireland.	N = 47 (no reference to sex); 15 athletes; 11 family members of athletes; 6 non-athletes; 7 family members of non-athletes and 8 staff members. No sample size calculation.	Not applicable	Not applicable	Focus group interviews; individual semi-structured telephone interviews; supplementary qualitative data extracted from four open ended questions contained in a quantitative survey used within the SOPHIE study.	For the athletes: benefits to physical health and well-being; the possibility of connecting socially; have a sense of purpose and belonging; they claim that the selection process is a barrier to progression. For athletes' families: the Special Olympics promotes family commitment; community social networks; provided opportunities to witness their achievements and be proud; To promote participation in the Special Olympics: better information about the Special Olympics.	Poor
Carbó-Carreté et al. (2016)	To analyse the relationship between the practice of PA and	N = 529 (male = 296; female = 233); 16-66 years old;	Not applicable	Not applicable	QoL—Personal Outcomes Scale–Spanish Adaptation;	The value obtained in the structural equation model	Poor

Spain, Europe	the QoL of people with IDD.	borderline, mild, moderate and severe IDD. Convenience sample; no sample size calculation.	(β11 = 0.703, p < 0.001) allows the authors to confirm that the levels of PA have an impact on the QoL of people with IDD. Thus, the data confirmed that PA acts as an important predictor of QoL improvement. The results present acceptable coefficients for the eight first-order factors (QoL domains) and for the three second-order factors (Independence, Social Participation and Well-Being). The well-being factor was the one that presented the highest values. A high value was also found in the Independence factor, specifically in the self-determination domain. The lowest value was associated with

					the Social Participation factor, in the domain of social inclusion, although this was considered a significant result.	
Carmeli et al. (2008), Israel, Asia	To understand whether there is a positive relationship between the perception of well-being and physical exercise among adults with IDD.	N = 60 (male = 14; female = 46); 46–77 years old. Mild IDD. Non-randomly selected sample; non-randomized groups: EG (N = 31) and CG (N = 29). No sample size calculation.	10 months; 3x a week; 40-45 min/session.	Warming-up movements; large body movements in sitting and standing for stability and flexibility; dynamic balance exercises; general strength training (light hand weights and elastic bands).	Self-perceived well-being—Harter's Self-Perception Profile Modified; Health and QoL—Nottingham Health Profile (NHP).	Higher change in self-perception of well-being assessed by the NHP for the EG. After the intervention program, significant differences were found for the EG in the following NHP domains: energy (p = 0.001), social isolation (p = 0.001) and physical mobility (p = 0.001). The authors observed significant differences in the mean NHP questionnaire score between the initial assessment and the final assessment in the EG. Through an analysis of variance, the	Fair

					authors found a significant difference between the groups in the specific domains of social acceptance (F = 8.79) and physical appearance (F = 3.15).	
Carmeli et al. (2005), Israel, Asia	To analyse the effect of a physical exercise program on balance, strength and general well-being in adults with IDD.	N = 22 (male = 7; female = 15); 54–66 years old; mild IDD. Non-randomly selected sample, divided into two groups qualitatively and quantitatively: general group A (n = 10: 7 = female; 3 = male) and group B (n = 12; 8 = female; 4 = male). No sample size calculation.	6 months; 3× a week; 40–45 min/session.	Balance-training program (group A): warming up movements; dynamic balance exercises (i.e., toe-to-heel walk, tandem standing, side walking, dance, roll a ball, push, pull, catching and throwing). Muscle strengthening program (group A): in each session seven basic exercises were used (knee extension, knee flexion, ankle plantar flexion, hip extension, hip abduction, trunk flexion and trunk extension); 1–2 sets; 8–10 repetitions; resting period of 2–4 min between sets; 5–10 min to complete each muscle group. General exercise program (group B):	Well-being questionnaire—the authors modified the Harter's self-perception profile (Aasland and Diseth, 1999).	Both groups showed improvements in self-concept of well-being. Group A (pre training vs. post training): 68 ± 7 vs. 83 ± 9, p = 0.05. Group B (pre training vs. post training): 67 ± 8 vs. 85 ± 8, p = 0.05.	Fair

				warming-up movements; large body movements in sitting, standing and walking for general mobility, stability and flexibility.			
Crawford et al. (2015), United Kingdom, Europe	To compare the impact of sports on the psychosocial behaviour of people with IDD who (1) are Special Olympics athletes, (2) do not practice any type of sport and (3) practice physical exercise or sports, but not through the Special Olympics.	N = 101 (male = 57; female = 44); 18–67 years old. Special Olympics group n = 51 Mencap Sport group n = 20 Mencap No Sport group n = 30 Missing data for eight participants reduced the total sample for statistical analyses to 93. Power calculations were performed to establish appropriate sample sizes (calculations suggested a sample size of 40 in each group).	Not applicable	Not applicable	QoL—The Life Experiences Checklist (LEC);	The Special Olympics group reported differences between the groups on total scores of LEC (Special Olympics: 23.4 ± 3.7; Mencap Sport: 21.0 ± 3.5; Mencap no Sport: 21.2 ± 3.7; Group Comparison: $x^2(2, 101) = 10.1$; $p = 0.006$), but also in the leisure and relationships subscales. No differences were found between the groups regarding the "opportunities" subscale.	Poor
Diz et al. (2021), Portugal, Europe	To analyse the effect of a regular PA program on the adaptive skills, motor competences, and QoL of institutionalized adults with IDD.	N = 16 (male = 7; female = 9); 24–61 years old; mild to moderate IDD. Convenience sample. Randomized groups: EG (N = 8) and CG (N = 8).	20 weeks; 2× a week; 50 min/session.	Active warm-up, core activities and stretching. PA program included rhythmic exercises, muscle strength and amplitude, spatial orientation, balance, body awareness, attention and memory.	QoL—Portuguese version of the Personal Outcomes Scale (P_POS)	In the last two assessment periods, better scores were recorded in most QoL domains for the EG, with a significant difference recorded between	Fair

		No sample size calculation.				the pre-intervention and post-intervention periods, in the total quality of life score, in the proxy version (pre- vs. post-intervention: 97.75 ± 8.46 vs. 101.750 ± 7.69, p = 0.01, r = 0.32).	
Fjellstrom et al. (2022), Sweden, Europe	To explore the feasibility and effectiveness of a web-based PA training program for people with IDD. A secondary outcome was to assess enjoyment of the training program and QoL.	N = 22 (male = 12; female = 10); 18–60 years old; mild to moderate IDD. No sample size calculation.	12 weeks; 3× a week; 50 min/session.	150 min per week of moderate PA; Combination of strength exercises and resistance exercises length with balance and flexibility. Different progression levels were applied to be able to meet the participants requirements (e.g., the participants could choose between jumping and walking to be able to meet the moderate intensity level).	QoL—Manchester Short Assessment of Quality of Life (MANSA);	The mean scores of the satisfaction items were 5.9 ± 0.92 pre-training and 5.8 ± 0.9 post-training. No significant differences were observed in QoL (p = 0.26 and r = 0.006), except for "leisure activities", where the score on the post-intervention tests was lower when compared to the score obtained before the intervention (p = 0.046).	Fair
Mercado et al. (2021), Spain, Europe	To study the benefits of dance as a tool for improving the QoL of people with IDD.	N = 9 (male = 1; female = 8); 22–58 years old; 3 dance teachers, 1 mother, 1 president of an association and 4 persons with IDD.	Not applicable	Not applicable	Semi-structured interview: vision and perception of the group's social inclusion and QoL.	The findings show the benefits and potential of dance regarding different dimensions of QoL and human functioning in	Poor

		Convenience sample. Level of education: 45% primary, 33% secondary and 22% university studies.				IDD persons, like personal development, physical and emotional well-being and interpersonal relationships. The results indicate that dance benefits the QoL of people with IDD.	
Moltó and Bruna (2017), Spain, Europe	(1) To analyse the practice of sports as a significant activity for people with IDD; (2) to analyse the association of sport with life satisfaction and self-determination; (3) to establish which type of sport is most associated with life satisfaction and self-determination.	N = 74 (male = 49; female = 25); aged 18 or over; mild to moderate IDD. EG (N = 42) and CG (N = 32). No sample size calculation.	Not applicable	Not applicable	Sociodemographic and sports questionnaire (constructed ad hoc for this investigation); satisfaction with life—Satisfaction with Life Scale (SWLS); self-determination—Arc's Self-Determination Scale.	The three main reasons why the participants participate in sport are as follows: (1) because they enjoy it and find it pleasurable, (2) for health reasons and (3) for the possibility of interacting with other people and making friends. No significant differences (p = 0.37) were found in SWLS between participants who played sports (28.36 ± 5.63) and those who did not (27.91 ± 4.60). Participants who practice team sports are more	Poor

					satisfied with their lives (p = −2.06; r = 0.58) and satisfied with the sporting activity (p = −3.63; r = 1.03). Also, individuals who practice team sports value their living conditions more (p = −2.28 and r = 0.59).	
Ozkan and Kale (2021), Turkey, Eurasian	To analyse whether there is a difference between the QoL and motor skills of children with IDD who participate in physical education activities for 14 weeks and those who do not.	N = 34 (male = 19; female = 15); 8–12 years old. EG 18 (male = 11; female = 7); CG: 16 (male = 8; female = 8). No sample size calculation.	14 weeks; 2× a week; 60–70 min/session.	Educational games; 1–8 weeks, basic skills were practiced. In weeks 9–14, the progress of children was considered and practices requiring more rapid movement and coordination were included.	QoL—Pediatric Quality of Life Inventory (PedsQL).	The inventory total score (p = 0.000) and all the other sub-scales of PedsQL of children with IDD who participated in the physical education activities program improved more, with significant differences, than children with IDD who did not participate in the program.	Fair
Pérez et al. (2017), Spain, Europe	To analyse the potential benefits of an aquatic exercise program on the health-related physical fitness and QoL of a group of adults with DS and identify the impact that the program	N = 14 (male = 7; female = 7); 21–49 years old. Moderate or severe IDD. No sample size calculation.	12 weeks; 2× a week; 45 min/session.	Warm up (15min): respiration exercises (time: 5 min; sets: 3 reps × 30 s × 2 sets; rest between repetitions: 5–10 s; rest between sets: 1 min; swimming speed: medium); crawl kicks while holding the edge	QoL—short modified version of a Spanish QoL questionnaire (applied to participants- self-report); QoL—World Health	The authors did not observe significant changes, on the self-report scale, in any of the QoL dimensions assessed in the study, indicating that the exercise	Fair

	may have on the self-perception of QoL of parents or caregivers.			of the pool (time: 5 min; sets: 3 reps × 30 s × 2 sets; rest between repetitions: 10 s; rest between sets: 1 min; swimming speed: medium-high); main part (30 min): crawl stroke (arms movement technique with pull buoy); crawl stroke (legs movement technique) and backstroke (legs movement technique)—time: 10 min; sets: 2 reps × 15 meters × 3 sets; rest between repetitions: 10 s–passive rest; rest between sets: 1 min—active rest; swimming speed: high); cool down (5 min).	Organization Quality of Life-BREF (WHOQOL-BREF) (applied to parents/caregivers).	program did not have a significant impact on the QoL of the participants (self-esteem and health, test: 2.45 ± 0.74; retest: 2.59± 0.61, p = 0.336; healthy habits, test: 3.39 ± 0.56; retest: 3.14 ± 0.60, p = 0.187; leisure time, test: 2.90 ± 0.82; retest: 3.11 ± 0.57, p = 0.220; and personal satisfaction, test: 3.07 ± 0.54; retest: 3.07 ± 0.61, p = 0.987). The same happened with the perception of QoL of parents and caregivers in relation to the participants (total score, test: 13.53 ± 1.49; retest: 13.65 ± 1.384, p = 0.587).	
Snapp et al. (2020), USA, North America	To provide evidence regarding the positive impact of interventions based on fundamental motor skills on the QoL of children with IDD.	N = 10 (no reference to sex); 4–14 years old; ASD, speech deficits, DS and fragile syndrome. No sample size calculation.	Three separate 10-week interventions; 1× a week; 1 h/session.	Each session followed the same general routine: 10–15 min of free play, 5 min warm up, 35 min of direct instruction, and 5 min cool down.	The instrument was applied six times, at the beginning and end of each 10-week intervention; QoL—Pediatric Quality of Life	Emotional function: an increase during the three interventions was observed, with a slight increase between the end	Fair

				Inventory 4.0 (PedsQL);	of the first and the beginning of the second intervention and a decrease between the end of the second and the beginning of the third intervention. Social function: an increase during the three interventions was observed, with a continuous increase between the end of the first and the beginning of the second intervention and a decrease between interventions two and three. Physical function: a decrease during the first intervention and an increase during the second and third interventions were observed. School function: an increase was noticeable during the second intervention.

Shields et al. (2015), Australia, Oceania	To investigate whether a PA program designed according to the Rimmer and Rowland (2008) framework was viable, whether the program was safe, and whether it led to improvements in walking ability, and to assess risk factors associated with chronic diseases and positive changes in participants' perceptions of well-being and changes in PA.	N = 16 (male = 8; female = 8); 18–35 years old; mild to moderate IDD. Convenience sample. Randomized groups: EG (N = 8) and CG (N = 8). No sample size calculation.	8 weeks;	150 min of moderate-intensity PA per week—two 45 min walks per week with a student mentor and another 60 min of PA (independent—without mentor)	Perceptions of well-being—The Life Satisfaction Scale.	There were no significant differences between the groups for perceptions of well-being. Intervention group (pre vs. post): 29.8 ± 7.5 vs. 28.2 ± 7.5. Control group (pre vs. post): 30.6 ± 4.6 vs. 31.3 ± 4.8. Difference between groups (Week 9–Week 0): −2.8 [−9.3, 3.6].	Good
Tomaszewski et al. (2022), USA, North America	(1) To describe the average PA for adults with ASD and IDD using PA meters, (2) to describe the QoL of adults with ASD and IDD and (3) to examine the relationship between PA counts steps and QoL.	N = 38 (71.1% male); 18–55 years old. Non-convenience sample. No sample size calculation.	All waking hours for 1 week.	Not applicable	QoL—Quality of Life Questionnaire (QOL-Q)	Satisfaction domain was significantly higher (23.37 ± 2.721) than the domains of competence (18.89 ± 6.75), independence (20.61 ± 3.45) and social belonging (21.28 ± 3.16). The competence domain and the total QoL value were significantly associated with weekly step count (p = 0.004, r =	Poor

				0.46 and $p <$ 0.001, r = 0.56). The total QoL score was regressed onto average steps per day, nonverbal IQ and age. Average steps per day, nonverbal IQ, and age accounted for 34.2% of the variance in quality of life. For every 1000-step increase in steps per day, the total QoL score increases by 2.56 points.

Note: CG, control group; EG, exercise group; min, minutes; IDD, Intellectual and Developmental Disability; N, participants; PA, physical activity; QoL, quality of life.

2.4.3. Characteristics of the Studies.

Table 1 presents the characteristics, results, and methodological quality of each of the studies included in the present review.

2.4.4. Origin

Of the 15 studies included in the systematic review, nine are from Europe (Portugal: (Diz et al., 2021); Spain: (Barnet-Lopez et al., 2016; Carbó-Carreté et al., 2016; Moltó & Bruna, 2017; Mercado et al., 2021; Pérez et al., 2017); United Kingdom: (Crawford et al., 2015); Ireland: (Bowers et al., 2016); Sweden: (Fjellstrom et al., 2022)), two are from Asia (Israel: (Carmeli et al., 2005, 2008)); two are from North America (USA: (Snapp et al., 2020; Tomaszewski et al., 2022)), one is from Oceania (Australia: (Shields & Taylor, 2015) and one is Eurasian (Turkey: (Özkan & Kale, 2021)).

2.4.5. Type of Studies

Of the 15 studies analysed and included in the present systematic review, 6 of them are cross-sectional studies and 8 of them are intervention studies.

2.5. Participants

Out of a total of 1026 participants, 995 are people with IDD, while the remaining participants are family members of people with IDD, teachers, technical carers, and association presidents. With regard to the age of the participants, it mostly ranges from 16 to 66 years old (Barnet-Lopez et al., 2016; Carbó-Carreté et al., 2016; Carmeli et al., 2005; Crawford et al., 2015; Diz et al., 2021; Fjellstrom et al., 2022; García Moltó & Ovejero Bruna, 2017; Mercado et al., 2021; Pérez et al., 2017; Shields & Taylor, 2015; To-maszewski et al., 2022), with only two studies using samples of children and adolescents aged between 4 and 14 (Özkan & Kale, 2021; Snapp et al., 2020) and one study with par-ticipants aged between 46 and 77 (Carmeli et al., 2008). Only one of the included studies made no reference to the age of the sample (Bowers et al., 2016). All but one of the studies (Bowers et al., 2016) assessed the QoL and/or well-being of the sample, with eleven studies showing positive results regarding the impact of PA, PE or sport on the QoL and/or well-being of the sample in question.

2.6. Exercise Prescription

Regarding the well-being variable, the studies that aimed to understand the influence of PA, PE or sports programs on this variable used the following exercise prescription.

In the study by Barnet-Lopez et al. (Barnet-Lopez et al., 2016), the program implemented aimed to develop rhythm, Laban effort, balance, coordination, grounding and free dance. In the studies carried out by Carmeli et al. (Carmeli et al., 2008) and Carmeli et al. (Carmeli et al., 2005), the PE programs developed by the authors focused mainly on balance training, flexibility and general strength training. The participants in the study by Carmeli et al. (Carmeli et al., 2008) performed 1 to 2 sets of 8 to 10 repetitions, with a rest of 2 to 4 min between sets. In the study by Shields et al. (Shields & Taylor, 2015), the participants had a goal of 150 min of moderate-intensity PA a week, taking two 45 min walks a week, accompanied by mentors, with the participants being responsible for the remaining 60 min of PA a week.

Regarding QoL, the studies included in this systematic review used the following exercise prescription.

In the study by Fjellstrom et al. (Fjellstrom et al., 2022), the main focus of the exercise program was balance training, flexibility and general strength training, with different levels of progression (e.g., jumping or walking) being implemented in order to respond to the needs of each participant. In the studies carried out by Ozkan and Kale (Özkan & Kale, 2021) and Snapp et al. (Snapp et al., 2020), the intervention programs had a more playful character, with the Ozkan and Kale (Özkan & Kale, 2021) study implementing educational games that promoted basic motor skills with progressions over time, taking into account the children's progress. Snapp et al. (Snapp et al., 2020) implemented sessions with free play and direct instructions also aimed at promoting children's motor skills.

In the study by Pérez et al. (Pérez et al., 2017), the participants completed a PE program in an aquatic context, consisting of a 15 min warm-up, with breathing exercises and crawl kicks, with two sets of three repetitions × 30 s each, with a rest of 5–10 s be-tween repetitions and 1 min between sets. The fundamental part, which consisted of swimming techniques with a high swimming speed, was organized into three sets of two repetitions × 15 m, with a 10 s passive rest and 1 min of active rest between sets. Finally, in the study by Diz et al. (Diz et al., 2021), the study population took part in a PA program based on

rhythmic exercises, muscle strength and amplitude, spatial orientation, balance, body awareness, attention and memory.

Given this population's tendency towards a sedentary lifestyle (Bartlo & Klein, 2011), which tends to negatively affect QoL (Cabeza-Ruiz et al., 2020), with lower levels of functional mobility, essential for carrying out daily life tasks (Apolone & Mosconi, 2007; Jacinto et al., 2023), participation in programs of this nature seem to have positive and significant effects on the QoL and well-being of people with IDD.

2.7. Evaluation Techniques

Different instruments were used to assess QoL in the studies presented, such as the Personal Outcomes Scale–Spanish Adaptation (Carbó-Carreté et al., 2016), the Life Experiences Checklist (LEC) (Crawford et al., 2015), semi-structured interviews (Mercado et al., 2021), the Quality of Life Questionnaire (QOL-Q) (Tomaszewski et al., 2022) , the Nottingham Health Profile (Carmeli et al., 2008), the Portuguese version of the Personal Outcomes Scale (P_POS) (Diz et al., 2021), the Manchester Short Assessment of Quality of Life (MANSA) (Fjellstrom et al., 2022), the Pediatric Quality of Life Inventory (PedsQL) (Özkan & Kale, 2021; Snapp et al., 2020), short modified version of a Spanish QoL questionnaire and the World Health Organization Quality of Life-BREF (WHOQOL-BREF) (Pérez et al., 2017).

The same is true for the well-being assessment instruments, which included the Human Figure Drawing Test (HFD) (Barnet-Lopez et al., 2016), focus group interviews, individual semi-structured telephone interviews, supplementary qualitative data extracted from four open ended questions contained in a quantitative survey (Bowers et al., 2016), Harter's Self-Perception Profile Modified (Carmeli et al., 2005, 2008), the Satisfaction with Life Scale (SWLS) (García Moltó & Ovejero Bruna, 2017) and the Life Satisfaction Scale (Shields & Taylor, 2015).

2.8. Discussion

The main aim of this systematic review was to analyse the state of the art on the role of PA, PE and sport in the QoL and well-being of people with IDD, seeking to understand what has been established and to contribute to future studies in the area.

2.8.1. Quality of Life

Carbó-Carreté et al. (Carbó-Carreté et al., 2016) found that PA levels have an impact on the QoL of people with IDD, and the results obtained seem to confirm that PA acts as an important predictor of increased QoL ($\beta 11 = 0.703$, $p < 0.001$). Also, the study carried out by Tomaszewski et al. (Tomaszewski et al., 2022), with the aim of analysing the relationship between the number of steps taken and QoL, showed that the total QoL score, as well as the competence domain, is significantly associated with the weekly step count, having found that for every increase of 1000 steps per day, the total QoL increases by 2.56 points.

Crawford et al. (Crawford et al., 2015), when comparing the impact that sport has on the psychosocial behaviour and QoL of people with IDD, found that the sample in their study, composed of Special Olympics athletes, showed differences in the total QoL score (23.4 ± 3. 7) and in the leisure and socialization domains when compared to the other groups ($\chi 2(2, 101) = 10.1$; $p = 0.006$), namely individuals who do not practice any type of sport (21.2 ± 3.7) or people who practice PE/sport but not through the Special Olympics (21.0 ± 3.5). Mercado and colleagues (Mercado et al., 2021) also analysed the possible benefits of dance in promoting the QoL of people with IDD and found that it provides benefits to the QoL of the population under study, particularly in the domains of personal development, physical and emotional well-being and interpersonal relation-ships.

In the study carried out by Carmeli et al. (Carmeli et al., 2008), after the end of the PE intervention program, the authors found statistically significant differences in the domains of energy ($p = 0.001$), social isolation ($p = 0.001$), physical mobility ($p = 0.001$) and the total QoL score in the experimental group. Analysis of variance found statistically significant differences between the groups in the domains of social acceptance ($F = 8.79$) and physical appearance ($F = 3.15$). Also in line with these results is the study carried out by Diz et al. (Diz et al., 2021), which analysed the effects of a PA intervention program on the adaptive behaviour, physical fitness and QoL of adults with IDD, and their results revealed significant differences in the total QoL score in the experimental group between the pre- and post-intervention moments (97.75 ± 8.46 vs. 101.750 ± 7.69, $p = 0.01$, $r = 0.32$).

PA also seems to promote QoL in children with IDD, and this can be seen in the studies carried out by Ozkan and Kale (Özkan & Kale, 2021) and Snapp et al. (Snapp et al., 2020). In the study conducted by Ozkan and Kate (Özkan & Kale, 2021), with the aim of verifying the existence of differences in QoL between children who practice physical education and those who do not, the authors applied a 14-week intervention program and found significant differences in total QoL ($p = 0.000$), as well as in all QoL subscales, in children who practice physical education compared to those who do not. The same was

observed in the study conducted by Snapp et al. (Snapp et al., 2020), where a pro-gram based on fundamental motor skills was applied in three different intervention period, in accordance with school breaks, with 10 consecutive weeks of intervention. After the intervention, the authors found an increase in emotional and social function in all intervention periods, an increase in physical function in the last two intervention periods and an increase in school function in the second intervention period.

Although most of the studies included in the systematic review found positive associations between PA, PE and sport and QoL, in the study carried out by Pérez et al. (Pérez et al., 2017), the authors found no significant differences in any of the QoL do-mains assessed in the study, in the self-report version (self-esteem: $p = 0.336$; healthy habits: $p = 0.187$; leisure time: $p = 0.220$ and personal satisfaction: $p = 0.987$) or in the version applied to relatives/carers ($p = 0.587$), after a 12-week intervention in an aquatic environment. The authors suggest that the lack of improvement in terms of QoL may be related to the fact that the participants' physical fitness did not display a significant in-crease after the intervention program (Pérez et al., 2017). The same was true in the study carried out by Fjellstrom et al. (2022), where there were no statistically significant differences in the QoL ($p = 0.26$; $r = 0.006$) of the individuals assessed after the web-based PA program, and it was even possible to observe a drop in the score for the "leisure activities" domain ($p = 0.046$). According to Fjellstrom et al. (Fjellstrom et al., 2022), this drop in scores can be explained by the fact that the study was carried out during the COVID-19 pandemic and there were various restrictions that may have affected the ex-tent to which participants had the opportunity to enjoy leisure activities. In addition, in the post-intervention period, the restrictions were more severe than before the intervention (Fjellstrom et al., 2022), which may have influenced the QoL results.

2.8.2. Well-Being

With the aim of analysing the relationship between sport and life satisfaction and understanding which type of sport is most associated with life satisfaction, Moltó and Bruna (Moltó & Bruna, 2017) found that there were no significant differences in life satisfaction ($p = 0.37$) between individuals who practice sport (28.36 ± 5.63) and those who do not (27.91 ± 4.60); however, participants who practice team sports are more satisfied with their lives ($p = -2.06$; $r = 0.58$) and value their living conditions more ($p = -2.28$; $r = 0.59$). Also, Bowers et al. (Bowers et al., 2016), when analysing the experiences and perspectives of athletes and their families in relation to the Special Olympics, found that for athletes, being part of the Special Olympics provides benefits for their physical health and well-being,

represents a chance to socialize and establish relationships, and provides a sense of belonging and a sense of purpose. For family members, the Special Olympics essentially promotes family commitment and the creation of community social networks.

Barnet-Lopez et al. (Barnet-Lopez et al., 2016), when analysing differences in the emotional well-being of adults with IDD after 26 dance sessions, found significant differences in the pre- and post-test scores of the experimental group ($p = 0.007$), while there were no differences in the control group ($p = 0.560$). The emotional indicators assessed were reduced in 13 participants in the experimental group.

In the study conducted by Carmeli and colleagues (Carmeli et al., 2008), after the PE intervention program, the authors found large differences in self-perceived well-being in the experimental group. The same happened in the study by Carmeli et al. (Carmeli et al., 2005), where the authors analysed the effect of a PE program on the balance, strength and well-being of people with IDD. The two intervention groups used different PE programs, but both showed improvements in self-perceived well-being (group A: $p = 0.05$; group B: $p = 0.05$).

In contrast, in the study carried out by Shields et al. (Shields & Taylor, 2015), in which participants performed 150 min of moderate to intense PA over 8 weeks, the results obtained are not in line with those mentioned above, as the authors found no significant differences between the control group and the experimental group ([95% CI]: −2.8 [−9.3, 3.6]) in terms of perceived well-being. According to the authors, the reason for these results is unclear, but they believe that it may reflect the physical effort that the participants had to exert to complete 150 min of at least moderate PA during the week (Shields & Taylor, 2015).

Despite the diversity of objectives and methodologies, participation in PA, PE or sports programs seems to have positive and significant results in terms of QoL (Carbó-Carreté et al., 2016; Carmeli et al., 2008; Crawford et al., 2015; Diz et al., 2021; Mercado et al., 2021; Özkan & Kale, 2021; Snapp et al., 2020; Tomaszewski et al., 2022) and well-being (Carmeli et al., 2008; Carmeli et al., 2005; Barnet-Lopez et al., 2016; Bowers et al., 2016; Moltó & Bruna, 2017) in people with IDD.

The results obtained in this systematic review seem to be corroborated by previous studies, such as the systematic review carried out by Bartlo and Klein (Bartlo & Klein, 2011), with the aim of systematically researching and critically examining the strength of research evidence on the effectiveness and feasibility of PA programs for adults with IDD, which verified the positive effects of PA on the perception of health and QoL in the population under study. The results are also corroborated by the systematic review carried out by Jacob

et al. (Jacob et al., 2023), in which the results obtained demonstrate the significant impact of PA on improving QoL in adults with IDD. Jacob et al. (Jacob et al., 2023) aimed to identify the benefits of PA in adults with IDD and to analyse the possible impact of PA based on gender difference.

In addition to the aforementioned studies, others carried out with individuals with motor disabilities, veterans with different types of disabilities and the elderly demonstrate the positive effects of PA, PE and sport on QoL, such as the study by Ganesh and Mishra (Ganesh & Mishra, 2016), in which the authors found a positive correlation be-tween PA levels and all QoL domains (physical health: $r=0.819$, $p<0.050$; psychological well-being: $r=0.776$, $p<0.050$; social relationships: $r=0.706$, $p<0.050$ and environment: $r = 0.627$, $p<0.050$) in adults with motor disabilities. The study by Laferrier et al. (Laferrier et al., 2015) seems to confirm the positive relationship between the QoL perceived by the veterans themselves ($r=0.40$, $p<0.001$) and the number of years they have been practicing sport, PE and/or recreational activities. The systematic review carried out by Wei et al. (Wei et al., 2022) also seems to corroborate these results, and found positive effects of PE on the QoL of healthy elderly people.

The same can be observed regarding well-being, with different studies corroborating the results obtained in this review, such as the systematic review by Windle et al. (Windle et al., 2010), in which the authors found a positive relationship between PE and PA and well-being in the elderly. Also, the results obtained in the systematic review by Borland et al. (Borland et al., 2020) seem to suggest a positive relationship between PA and psychological well-being in children and adolescents with IDD. The same can be seen in the study by Hassmén et al. (Hassmén et al., 2000), where the authors found that individuals with IDD who practiced PE more frequently had lower scores on questionnaires measuring negative affect and higher scores on measures of positive affect (e.g.,: depressive symptoms $p<0.001$; perceived stress $p<0.01$ and social integration $p<0.001$), contributing to their psychological well-being (Hassmén et al., 2000).

2.8.3. Exercise Prescription

Taking into account the characteristics of the intervention programs of the studies included in this systematic review, the differences between them are prominent, with the duration of the interventions varying from eight weeks (Shields & Taylor, 2015) to ten months (Carmeli et al., 2008), from one (Tomaszewski et al., 2022) to three sessions (Fjellstrom et al., 2022) a week and the duration of the sessions varying from 45 min (Pérez

et al., 2017) to 70 min (Özkan & Kale, 2021). However, it was possible to see two common points between most of the interventions—the warm up and a return to calm (Barnet-Lopez et al., 2016; Carmeli et al., 2005; Diz et al., 2021).

2.9. Limitations, Future Research and Practical Application

The authors of the articles included in this systematic review highlighted some limitations found in their studies that should be taken into account for future studies, such as the lack of validity and reliability of some of the tests applied (Barnet-Lopez et al., 2016; Mercado et al., 2021; Pérez et al., 2017; Tomaszewski et al., 2022), the selection and recruitment of participants that does not reflect the actual pattern of the population (Mercado et al., 2021; Shields & Taylor, 2015), the sample size that does not allow for the generalization of the results obtained (Bowers et al., 2016; Carmeli et al., 2005; Diz et al., 2021; Özkan & Kale, 2021; Pérez et al., 2017; Shields & Taylor, 2015; Snapp et al., 2020; Tomaszewski et al., 2022), short intervention programs (Diz et al., 2021), the lack of a control group (Pérez et al., 2017; Snapp et al., 2020), interviewers not being blind to the grouping of participants (Crawford et al., 2015), and PA being assessed subjectively rather than objectively (Fjellstrom et al., 2022).

It should also be noted that five of the studies identified had poor methodological quality, especially due to problems related to the low representativeness of the sample as well as the lack of calculation of the sampling power. Thus, as future recommendations, the authors of the studies emphasize the need to include people with severe IDD, not restricting the sample to people with mild and moderate IDD (Carbó-Carreté et al., 2016), to assess QoL using validated assessment scales (Mercado et al., 2021; Tomaszewski et al., 2022), to use more meaningful and representative samples of the study population (Barnet-Lopez et al., 2016; Bowers et al., 2016; Carbó-Carreté et al., 2016; Carmeli et al., 2005; Diz et al., 2021; Moltó & Bruna, 2017; Özkan & Kale, 2021), to carry out subgroup analyses (e.g., by age, level of severity, gender) (Barnet-Lopez et al., 2016; Moltó & Bruna, 2017), to consider clinical and biological parameters and VO_2 analysis (Diz et al., 2021), to analyse sports interventions (Snapp et al., 2020), to analyse the impact of different sports on QoL and the impact of sport on different life cycles (Moltó & Bruna, 2017), and finally, to perform longitudinal and follow-up studies to identify the response to programs (Bowers et al., 2016; Crawford et al., 2015; Diz et al., 2021).

This systematic review addresses and shows a set of factors and benefits that support the integration of the practice of PA, PE or sport as a fundamental element in im-

proving the QoL and well-being of people with IDD. It is important that the practice of these activities is carried out regularly, prescribed and monitored by professionals with basic training in sports science and specific training in IDD. Considering a multidisciplinary approach, integrated into primary and secondary health services, it is necessary to update intervention strategies for this population, including the incorporation of PA, PE or sport into their routines, which is fundamental for maintaining and improving physical fitness and functional capacity and, consequently, improving the QoL and well-being of people with IDD.

2.10. Conclusions

According to the studies included in this systematic review, we can conclude that the practice of PA, PE and sport seems to contribute to improving the QoL and well-being of people with IDD.

Despite the growing research interest in this area, there is still a notable lack of studies exploring the impact of these programs, especially sports-based programs, on the QoL and well-being of this population, with studies presenting small samples and unsatisfactory methodological quality. In light of this, more studies are needed to better analyse the characteristics of intervention programmers and their effects on the QoL and well-being of people with IDD. Specifically, it would be important to carry out RCT studies that analyse the role that practicing sports can have on the QoL of people with different levels of severity of IDD, as well as analysing the role of other variables in this relationship (e.g., level of education, socioeconomic status and employability).

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Chapter 3 – Study II: Functional fitness and quality of life in people with intellectual and developmental disabilities: an exploratory study

Diz, S., Jacinto, M., Monteiro, D., Matos, R., Garrido, N., Costa, A. & Antunes, R. (2024). Functional fitness and quality of life in people with intellectual and developmental disabilities: an exploratory study. *Motricidade, 20*(2). https://doi.org/10.6063/motricidade.33482

Note: Article published in Portuguese and subsequently translated into English

3.1. Abstract

Despite physical exercise is a good indicator of health promotion, the population with intellectual and developmental disabilities tends to have high levels of physical inactivity that influence their physical fitness, health and QoL. The present study aimed to analyse the functional physical fitness and QoL, as well as the associations between them, of a sample of the population with IDD. Thirty-seven individuals (42,54± 11,12 years) with IDD were evaluated through the tests standing up and sitting on a chair, timed up and go and walking for 6 minutes, with the purpose of analysing physical fitness and the Personal Outcome Scale (POS) to measure physical well-being. Pearson's correlations were applied and the correlation between physical well-being and the tests stand up and sit down and walk for 6 minutes was verified. The results indicate an association between functional skills measured through the tests and physical well-being, suggesting that the promotion of these skills can positively influence the physical wellbeing of the sample used.

Keywords: intellectual and developmental disabilities; physical exercise; physical well-being; functional fitness.

3.2. Introduction

IDD is a deficit in intellectual and adaptive functioning in the conceptual, social, and practical domains, which manifests before the age of 21 (Schalock et al., 2021). The different degrees of severity of IDD (mild, moderate, severe or profound) are defined by adaptive abilities, rather than solely by intelligence quotient scores (American Psychiatric Association, 2013). By adaptive abilities, we mean 'a set of conceptual, social and practical skills that have been learned and are performed by people in their daily lives' (Saviani-Zeoti & Petean, 2008). Their assessment can be carried out through direct observation, interviews and/or individualised measures that are culturally adapted and psychometrically appropriate (Saviani-Zeoti & Petean, 2008). In this sense, adaptive behaviour seems to be the most important predictor of QoL in this population (Simões & Santos, 2017).

QoL is defined as a person's perception of their position in life, their goals, cultural and personal values, standards and expectations (World Health Organization Quality of Life Group, 1997), across a variety of dimensions. Assessing QoL allows individuals to be guided towards the life they value and approve of (Schalock & Verdugo, 2002). The conceptual model of QoL in IDD involves eight domains, which are the same for everyone, whose relevance must be determined by the individual: individual development and self-

determination; rights, interpersonal relationships and social inclusion; emotional, physical and material well-being, which give rise to three factors — independence, participation and well-being, respectively (Schalock & Verdugo, 2002; Simões et al., 2016). The domain of physical well-being is related to overall health and health care, the individual's ability to care for themselves, mobility, and recreational, leisure and sports activities (Simões & Santos, 2014).

Although physical well-being is seen as a determining indicator of QoL (Saviani-Zeoti & Petean, 2008), people with IDD tend to have higher levels of overweight/obesity, type II diabetes, hypertension, and cardiovascular disease (Haveman et al., 2010; Krahn & Fox, 2014; O'Leary et al., 2018), which can lead to lower scores in this domain. Despite the contribution of numerous factors to these conditions (Emerson et al., 2014), physical inactivity emerges as one of the greatest risk factors for the health of this population (Bergström et al., 2013; Esposito et al., 2012; McKeon et al., 2013; O'Leary et al., 2018). As a result of physical inactivity, people with IDD also tend to have low levels of physical fitness, including reduced levels of strength, aerobic capacity, balance and flexibility (Chow et al., 2018; Wouters et al., 2017) with repercussions on gait (Cleaver et al., 2009), postural control (Lahtinen et al., 2007), object manipulation (Enkelaar et al., 2013) and, consequently, success in performing activities of daily living (Oppewal et al., 2014).

Despite evidence of the impact of PA and PE on the prevention of obesity, type II diabetes, arthritis, hypertension (Bartlo & Klein, 2011), promotion of psychosocial well-being (Blick et al., 2015; Crawford et al., 2015; Perić et al., 2022) and physical well-being (Alesi & Pepi, 2017), people with IDD continue to maintain a sedentary lifestyle, with low levels of PA and PE (Stancliffe & Anderson, 2017; Van der Putten et al., 2017), which is the most significant factor in increasing the risk of developing the aforementioned comorbidities (Lynch et al., 2022).

In addition to the benefits related to physical fitness, the benefits of regular PA and PE practice on the QoL of this population have also been highlighted, with significant improvements in overall QoL (Carbó-Carreté et al., 2016; Pérez-Cruzado & Cuesta-Vargas, 2016; Tomaszewski et al., 2021), general health (Blick et al., 2015), directly related to physical well-being (Simões & Santos, 2014) and physical well-being (Carbó-Carreté et al., 2016; Jardim & Santos, 2016). As well as improvements in general well-being (Carbó-Carreté et al., 2016; Carmeli et al., 2005, 2008), balance and muscle strength (Carmeli et al., 2005; Shields et al., 2008) and psychosocial skills (Blick et al., 2015; Perić et al., 2022).

Functional capacity seems to be related to higher QoL indices, which has been verified in some studies, such as the work developed by Williams et al. (2021), where the

authors found that lower functional capacity indices are associated with lower QoL. Corroborating these results, in a study conducted with older adults, the authors found higher QoL indices in older adults with greater functional capacity (Costa et al., 2020). Also, in the study conducted by Arnaud et al. (2008), the authors found that lower levels of functional capacity and higher degrees of motor and/or intellectual disability severity are associated with lower values in several domains of QoL (e.g., physical well-being, autonomy).

Thus, the present study aims to analyse the functional physical fitness and QoL (particularly in relation to physical well-being) of a sample population with IDD, as well as to analyse the associations between these variables.

3.3. Method

3.3.1. Sample

The sample consisted of 37 individuals with IDD, institutionalised, with a mean age of 42.54 years (sd= 11.12). Of these, 18 (48.6%) are female and 19 (51.4%) are male.

3.3.2. Procedures

In accordance with the Declaration of Helsinki, all ethical procedures were ensured. In the initial phase, contact was established with the management of the institution where the research was to be carried out, and the objectives and different stages of the study were explained. After authorisation was granted, informed consent forms were sent to the participants and their carers/guardians, containing all the details about the study, informing them that they could withdraw at any time and that participation would not compromise the physical and psychological integrity of the participants, ensuring the confidentiality and anonymity of the data. After the signed documents were collected, the project began.

The instruments were applied according to the protocols, in the institution's rehabilitation room, by a professional accredited for this purpose, individually, without distracting stimuli that could compromise the participant's performance.

3.3.3. Instruments

The objective of the Fullerton Scale is to assess the main underlying physical parameters associated with mobility and functional capacity (Rikli & Jones, 2013), and its tests are valid and reliable for the study population (Cabeza-Ruíz et al., 2019; Hilgenkamp et al., 2012; Wouters et al., 2017). The following tests were used in the present study: standing up and sitting down on a chair; sitting, walking (2.44 m) and sitting down again, and walking for six minutes (Rikli & Jones, 2013). According to the authors, for the 'standing up and sitting down on a chair' test, the score involves considering the number of times the individual performs the task correctly, within a maximum time of 30 seconds. In the "sitting, walking (2.44 m) and returning to sit" exercise, performance is rated based on the total time taken to complete the task, and in the "walking for 6 minutes" test, the total number of metres walked in 6 minutes is recorded (Rikli & Jones, 2013).

The Personal Outcome Scale (POS) assesses the QoL of people with IDD (Simões & Santos, 2017) and has been validated at the national level (Simões et al., 2016). The scale assumes the conceptual model of eight domains: personal development, self-determination, interpersonal relationships, social inclusion, rights, emotional well-being, physical well-being, and material well-being, which together give rise to three factors: independence, social participation, and well-being. The EPR consists of 40 items rated on a 3-point Likert scale that vary according to the objectives of the items (Simões et al., 2016).

The Portuguese version of the scale was examined for reliability and criterion and construct validity. Reliability was confirmed, as was criterion validity (Simões et al., 2016). Confirmatory factor analysis confirmed the multidimensionality of the construct, finding eight domains and three factors (Simões et al., 2016; Simões & Santos, 2017), with composite reliability values above .70 (Simões et al., 2016).

3.3.4. Statistical analysis

Considering that the sample size (n= 37) assumed normal distribution, based on the assumptions of the central limit theory (n>30), as recommended by Hair et al. (2019). Subsequently, a descriptive analysis was performed using some measures of central tendency and dispersion, including the 95% confidence interval, for the entire sample. Pearson correlations were also performed, considering the following intervals: .10-0.30 (weak correlation); 0.31-0.50 (moderate correlation); >0.50 (strong correlation) (Cohen,

1988). For this analysis, a value of $p<0.05$ was assumed to reject the null hypothesis (Ho, 2014). The data were analysed using SPSS v.27 statistical software.

3.4. Results

Table 2 presents the descriptive statistics of the sample studied, showing the values of the functional physical fitness tests as well as the physical well-being domain score for the entire sample studied (n= 37).

Table 2 - Descriptive statistics for the entire sample studied (n=37)

	n (%)	Mean	
		mean±sd	(CI 95%)
Age (years)		42,54±11,12	(38,83–46,25)
Sex			
Female	18 (48,6%)		
Male	19 (51,4%)		
Sit-to-stand (repetitions)		11,35±4,39	(9,89–12,82)
TUG (seconds)		10,63±5,02	(8,95–12,30)
6 minutes walking (metres)		395,82±114,98	(357,49–434,16)
Physical Well-Being		12,30±1,78	(11,70–12,89)

Notes: SD, standard deviation; CI 95%, 95% confidence interval

With regard to the correlation between the variables under study, Table 3 highlights the significant correlations between physical well-being and the sit-to-stand test, as well as between physical well-being and walking.

Table 3 - Bivariate correlation between the variables under study

	1	2	3	4
1. Sit-to-stand	**1**	--	--	--
2. TUG	- 0,73**	**1**	--	--
3. 6 minutes walking	0,73**	-0,66**	**1**	--
4. Physical Well-being	0,43**	-0,17	0,48**	**1**

*p< 0.001.

3.5. Discussion

This study sought to analyse the functional physical fitness and QoL of a sample population with IDD, as well as to analyse the associations between these variables.

Although there are no reference values for this population that allow us to analyse and compare the values measured through functional tests, it is possible to compare them with other studies where the sample also consists of people with IDD. In this sense, it was possible to verify that, regarding the sit-to-stand test, in the study conducted by Boer and Moss (2016), the values obtained are higher than our results, with an average of 14.4 repetitions in the test and retest. However, when compared to the study by Hilgenkamp et al. (2012), where the results obtained vary, on average, from 9 repetitions in the test, 9.3 in the second test and 8.3 in the third, the values in the present study are slightly higher and identical to the results obtained by Jacinto et al. (2022). Knowing that ageing influences the deterioration of people's functional abilities (Laurienti et al., 2006), the higher values in the study by Boer and Moss (2016) can possibly be justified by the difference in age and a higher strength index, since their sample has an average age of 33.6 and that of the present study is 42.54. The study by Jacinto et al. (2022) presents an average age closer to our data, and Hilgenkamp et al. (2012) presents a higher average, which, in turn, may reflect the lower results in this test.

Regarding TUG, the results obtained appear to be lower when compared to other studies (Cabeza-Ruíz et al., 2019; Vereeck et al., 2008), which may suggest that the study population has lower agility, dynamic balance, and mobility indices (Cabeza-Ruíz et al., 2019).

In studies conducted by Boer and Moss (2016), Cabeza-Ruíz et al. (2019), Guerra-Balic et al. (2015), and Jacinto et al. (2022), the values obtained in the 6-minute walk test range from 513 metres to 578 metres, 449.6 metres to 531.7 metres and 463.08 metres to

457.44 metres in the retest, 354 metres to 617 metres, respectively, which are higher than those obtained by the authors. These differences may be related to lower levels of strength, motor coordination, and cardiorespiratory capacity (Gibbons et al., 2001).

The results obtained for physical well-being are similar to the values reported by Jacinto et al. (2022).

With regard to the analysis of the correlation between the variables under study, associations were identified between the domain of physical well-being and the stand-up and sit-down and walking tests. On the other hand, there were no associations between physical well-being and the TUG test. Since physical well-being, one of the domains of QoL assessment, is related to overall health, with an individual's ability to care for themselves, mobility, and recreational, leisure, and sports activities (Simões & Santos, 2014), the associations between physical well-being and walking and between physical well-being and the sit-to-stand test presented in this study seem to make sense.

Higher lower limb strength contributes to reducing the risk factors for falls and decreasing pain intensity (Araújo, 2011). The correlation between the stand-up test, which essentially assesses lower limb strength (Rikli & Jones, 2013), and physical well-being seems to be associated with this factor, since strength is necessary for various tasks that require mobility, such as household chores and walking (Carmeli et al., 2005), which are linked to the physical well-being of individuals.

Regarding the correlation between physical well-being and the walking test, which assesses cardiorespiratory fitness and lower limb strength (Rikli & Jones, 2013), this seems to suggest the importance of these physical fitness factors in the present domain of QoL, since cardiorespiratory fitness is partly related to the ability to perform activities of daily living (Guralnik et al., 1995) and to overall health (Al-Mallah et al., 2018).

These results reinforce the importance of implementing PE programmes to promote functional abilities and QoL in this population. In this regard, Carmeli et al. (2005) conducted a study analysing the influence of a PE programme on various physical abilities and, in addition to the positive relationship between perceived well-being and PE, they observed improvements in physical abilities. Also, in the study conducted by Pérez-Cruzado and Cuesta-Vargas (2016), where they applied a PA programme, they observed an increase in physical fitness and QoL in individuals with IDD. Through the promotion of PE programmes that include strength training, it is possible to increase strength in both the lower and upper limbs, contributing to a reduction in fat mass and an increase in fat-free mass (Jacinto et al., 2022).

It therefore seems important that future research consider conducting intervention studies (e.g., RCTs) that analyse the influence of PE on the functional capacities and QoL of people with IDD, emphasising physical well-being, with significant samples and different degrees of IDD severity. In addition, it seems pertinent to create a scale that assesses physical fitness, specifically adapted to people with IDD, based on their motor characteristics, which allows for the correct comparison of data, since this population does not have the same characteristics and motor skills as the general population.

3.6. Conclusion

Despite the still scarce evidence in this area, there are several studies that analyse QoL in this population. In this sense, the present study aims to contribute to the development of this knowledge, highlighting the correlation found between well-being, QoL domain, and the stand-up and sit-down and 6-minute walk tests.

These results suggest that, for the present sample, certain functional capacities appear to be associated with and influence physical well-being. These results seem to reinforce the idea of the importance of PE and functional capacities for the health, well-being, and QoL of this population. However, despite the evidence on this topic, this population continues to exhibit sedentary behaviours that may contribute to the decline in their health and QoL. In this sense, it is essential that PE begins to be seen as an asset for this population and that they are offered the opportunity to learn about, experience and practise it, whether in the community, institutions, clubs or even in their own homes.

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Chapter 4 – Study III: The use of control group in research design: the ethical challenge in the population with intellectual and developmental disabilities

Diz, S., Jacinto, M., Monteiro, D., Matos, R., Esteves, D., Costa, A. & Antunes, R. (2024). The use of control group in research design: the ethical challenge in the population with intellectual and developmental disabilities. *Motricidade, 20*(4), 359 -365. https://doi.org/10.6063/motricidade.30653

4.1. Abstract

Ethics studies the moral values and defines good and bad conduct in research and researchers. In the area of research with human beings, it plays a crucial role in imposing limits, reducing abuses, and providing fair lines of research. The use of control groups in this type of research has been addressed and seems to be an effective method to assess the effects of an intervention, but it has raised doubts about the ethical challenges it involves. Therefore, this narrative review aims to address the ethical challenges in the use of control groups in research projects. In the analysed studies on populations with IDD, it was found that most researchers favoured the use of control groups which, during the research period, did not engage in any activity other than the usual activities in their daily lives. However, they should ensure that the control group has the opportunity to perform an intervention equal to the one performed by the experimental group, after the end of the research. In addition, it was possible to verify that, for the most part, the authors ensure the follow-up of ethical standards in studies with human subjects.

Keywords: control group; experimental group; ethical challenges; intellectual and developmental disabilities; research design.

4.2. Introduction

Over the years, much has been studied regarding ethical issues. The term ethics, that comes from the Greek of Plato and Aristotle, means the habitual way of behaviour and defines good or bad conduct (Shephard, 2002). It studies moral values, morality being the right motives and actions of a person (Lumpkin, 2016). In the area of research involving human beings, this is an extremely important topic that assists researchers to pursue lines of research and intervention that are appropriate and equitable among all. However, this type of research raises ethical issues related to how the people participating in the studies should be treated by researchers (Oliver, 2010).

In this sense, any research involving the participation of human beings should be submitted to an institutional ethical board in order to achieve the ideal balance between the rights and needs of potential participants, society and researchers (Kent, 1997). It is essential that ethics committees ensure compliance with formal codes of ethics, such as the Declaration of Helsinki, but also do not neglect to review the proposed research against general ethical principles (Shephard, 2002).

The Declaration of Helsinki, created by the World Medical Assembly in 1964, is considered the most important international document addressing the ethical procedures in human research (World Medical Association, 1996). This document argues that the purpose of human research should always be to improve the knowledge about the disease and its treatment (World Medical Association, 1996). In order to guarantee good practices in human research, the Declaration of Helsinki includes standards which aim to guide researchers in the preparation and application of their studies (World Medical Association, 1996). Thus, and although all the rules are essential to ensure the ethical compliance of research, it is important to emphasize the need for a careful and meticulous assessment of the possible risks in comparison to the probable benefits, taking into account that the interests of the subject should always prevail over the interests of science and society. Also noteworthy is the rule that addresses the privacy and impact of the study on the physical and mental health of those involved, as well as the rules concerning informed consent, the possibility of abandoning the study at any time, and the recognition of the equality of all human beings (World Medical Association, 1996).

Regarding research with humans (with or without disabilities), three fundamental ethical principles should apply: 1. respect for persons, including their autonomy and right to self-determination; 2. beneficence for participants and the community by maximizing benefits and minimizing risks; and 3. justice, both legally and morally, in the treatment of those involved in research and in the treatment of the communities to which the participants belong (*Council for International Organizations of Medical Sciences* (2002).

In research involving the participation of human beings, control and experimental groups are often used. The control group allows researchers to investigate and analyse the influence of a variable, which is an essential part of scientific research (Pithon, 2013). However, the use of control groups is not consensual, although this type of methodology proves to be useful in many investigations, since using an exquisite control group, the possible significant improvements acquired during or after the intervention, by the experimental group, are more likely to be attributed to the intervention, strengthening the credibility of the results obtained (Kinser & Robins, 2013). In this way, the use of the control group helps researchers to differentiate the results obtained in the applied intervention from the results related to variables unrelated to the research (Kinser & Robins, 2013).

However, it is necessary to understand that in research with human beings, the well-being of the participants takes priority over any other interests and, therefore, essential ethical issues must be taken into account in the planning and application of the research. Participants in research involving the use of control groups should have access to all the

necessary care that they already enjoy, since an untreated control group is unethical when conducting research in clinical populations (Kinser & Robins, 2013). Furthermore, all participants should be fully informed about the objectives, methodological processes and purposes of the studies (Annoni, 2018; Sarker, 2014), the studies must not be harmful to the participants and the groups should be randomised as everyone has the right to benefit from a presumably better service (Annoni, 2018; Conner, 1980).

Thus, the aim of this narrative review is to analyse what has been established on the topic and address the ethical challenges related to it.

4.3. Main findings

4.3.1. Control Group

Regarding to the control groups, it should be taken into account that they must necessarily be composed by individuals with the same characteristics as the individuals belonging to the experimental group. The control group allows researchers to investigate and analyse the influence of a variable, which is an essential part of scientific research (Pithon, 2013).

According to Street and Luoma (2002), there are fundamental reasons for including a control group in a study involving intervention. Studies comprising control and experimental groups have the possibility of analysing in a detailed way the effects of one or more variables on the participants. In addition, the use of these groups allows researchers to understand if the results obtained are not caused by the patient's expectations or beliefs. If the main variables unrelated to the research are discarded, the result will be more reliable (Street & Luoma, 2002). Also, Kinser and Robins (2013) believe that control groups are necessary to understand, in a clear way, if the results are exclusively or largely due to the applied variable or if they are related to external factors. If an individual belonging to the experimental group shows significant improvements during or after the end of an intervention and a control group maintains the same results as the baseline, it is possible that the improvements are attributed to the intervention, thus reinforcing the results obtained by the researcher. In this way, it is essential that the design of a control group is as exact as that of an experimental group (Kinser & Robins, 2013).

In non-pharmacological research, where "placebo" control groups are not used, the most common types of control groups are the one in which usual care is maintained, that is,

only the care that the individual is used to and/or needs is maintained; the control group which will benefit from the intervention, that is, the one which continues to receive the usual care which was used until then and, after the end of the research, will have the opportunity to receive the same intervention as the experimental group. Finally, the active control group, in which individuals receive some type of intervention during the study, which allows keeping their expectations and attention under control (Lindquist et al., 2007; Street & Luoma, 2002).

4.3.2. Ethical challenges associated with the use of control groups

Before the initiation of any experimental intervention involving the participation of human subjects it is essential that all ethical issues are considered (Oliver, 2010; Kent, 1997; World Medical Association, 1996).

In any intervention, be it pharmacological, behavioural, motor or cognitive, the researcher should seek a favourable balance between the benefits and harm that may eventually arise from the outcome of the research (Shephard, 2002). That said, the researcher should conduct the research, according to the appropriate risk management, by qualified researchers and technical support staff, having all the necessary care, in an appropriate environment in order to protect the privacy of those involved and safeguard any possible situation (Harriss & Atkinson, 2009; World Medical Association, 1996).

According to the Declaration of Helsinki (World Medical Association, 1996), all research participants should receive the best possible response to a problem, and it is only acceptable that this does not happen when there are no proven interventions, when patients receiving a less effective treatment than the best proven one are not subject to avoidable risks for not receiving the best proven treatment, and when the methodological reasons are scientifically consistent enough to prove that the use of an untreated control is necessary to determine the effectiveness of the variable under study (World Medical Association, 1996). Thus, a no-treatment control group is unethical when conducting research with clinical populations because, from the outset, there is a known effective therapy or minimum level of care expected, depending on the severity of the clinical condition (Kinser & Robins, 2013).

Millum & Grady (2013) refer that a placebo control is necessary to demonstrate efficacy, but sometimes the risks of forgoing treatment make unethical to ask participants to accept them, since the risks of forgoing or delaying treatment should not be negligible.

In the case of sport or exercise, given their proven health benefits, asking recipients belonging to the control group not to perform any exercise, when they were already doing

so, or doing so to a lesser extent is a request contrary to that set out in the Declaration of Helsinki (Oliver, 2010).

Any research team should take into account several factors that call into question the ethics of using control groups in research. Thus, it is essential that the research has a valid scientific basis (Miller, 2008), that the individuals belonging to the control group are not exposed to excessive risks, such as foregoing a medication/therapy that has proven to be effective (Annoni, 2018; Sarker, 2014), that there is no "therapeutic equivocation", that is, that all participants are well informed about the research objectives, methodologies and procedures (Annoni, 2018; Sarker, 2014), this implies that all participants should sign the informed consent but above all, understand what is intended by the research and be entitled to an equal opportunity (Sarker, 2014; World Medical Association, 1996). Informed consent should contain the research objectives, methodology, anticipated benefits and potential risks, right to refuse participation or withdraw from participation without any reprisal, conflicts of interest, funding sources and institutional affiliations (Harriss & Atkinson, 2009). In the case of research involving children or populations who cannot autonomously give informed consent, researchers should seek the consent of the responsible person and the assent of the participant. It should be noted that any research involving people with physical disabilities and/or IDD can only be conducted if the individual's disability, which does not allow him/her to sign informed consent, is a characteristic of the population being researched (Harriss & Atkinson, 2009).

When control and experimental groups are used in research, it becomes possible through the control group to reduce the various biasing factors that may influence the research findings (Sarker, 2014; Lindquist et al., 2007). Furthermore, when these are designed randomly, the possibilities of bias by the researcher while selecting participants for different groups are minimized and consequently, the effects of confounding variables are minimized.

However, control and experimental groups should only be designed when there is sufficient uncertainty about whether the new treatment is better than the existing one or not, since on the off chance that one group of study participants receives a better treatment than the other, several ethical issues arise (Sarker, 2014).

4.4. Discussion

The present study sought to analyse the established ethical challenges regarding the use of control groups in experimental studies with human beings, given their

methodological relevance, with particular emphasis on studies carried out with people with IDD, within the scope of PA and PE.

As has been mentioned, in the case of non-pharmacological intervention, there are distinct control groups, however, those in which they do not receive any type of intervention during or after the study seems to be the least ethical, since all individuals should be entitled to the same opportunities (Sarker, 2014). In this way, if the intervention programme is applied after the end of the study or another type of beneficial intervention is promoted for the control group, provided that it is different from the one used for the experimental group, all participants in the study will benefit.

In this sense, it becomes relevant to understand how researchers have addressed this and other ethical issues in the development of their studies, in different contexts. With regard to sports sciences, and particularly in studies with disabled people, this fact becomes particularly relevant, given the need for more studies (preferably RCT) with this population (Jacinto, Frontini, Matos & Antunes, 2021). Specifically, regarding people with IDD, since this is a population subgroup that, due to their intellectual and adaptive limitations (American Psychiatric Association [APA], 2013), cannot always make themselves heard, being necessary the faithful compliance with ethical standards so that the rights of individuals are fulfilled and their opinion and wishes are taken into consideration.

In a study conducted by Álvarez and collaborators (Gómez et al., 2018), in which the objective was to analyse the effect of a virtual reality-based intervention on the motor development and postural control of children with Down Syndrome, the authors conducted quasi-experimental research. The participants were randomly divided into an experimental group and a control group. The authors informed the guardians and participants about the procedures, aims, objectives and methods of the study, and the informed consent was signed by them, as this is a group of children. The research project was approved by the bioethics committee of the Adventist University of Chile (Gómez et al., 2018). In this way, the authors ensured that all the procedures followed were in accordance with the ethical standards of the World Medical Association and the Declaration of Helsinki. Throughout the research, the control group did not perform the intervention having maintained only the usual activities of daily living, including therapies. The results obtained by the authors after the intervention were positive, however there is no record in the article about the possibility of the programme being applied to the control group after the end of the investigation. This raises some ethical questions: once the positive effects of the intervention programme have been verified, should it not be ethically applied to the control group? With the methodology used in this study, the control group did not benefit at any time from the research.

In contrast, in the randomized controlled trial (RCT) conducted by Vreuls et al. (2022), with the aim of understanding the effects of indoor climbing on the employability and professional self-efficacy of people with IDD who have lower levels of social skills, the authors ensured that the control group would have the opportunity to enjoy indoor climbing sessions after the end of the intervention programme, for the same period of time and under the same conditions as the experimental group. In the present study, the participants were randomly distributed using a randomisation programme into three groups, an experimental group and two control groups. The experimental group had indoor climbing sessions, while the first control group had a sports programme and the second control group had no additional programmes, other than those which were already part of their daily activities. By providing the opportunity for control group participants to enjoy the indoor climbing sessions after the study had ended, Vreuls and colleagues (2022) considered that the waiting time for participants would not be excessive and the risk of dropout would be lower. Similarly, to the study discussed above, Mitchell et al. (2013) also conducted an RCT with the aim of understanding the effectiveness of a walking-based intervention designed for adults with IDD, in which the control group did not take advantage of any activity other than the usual ones. However, as soon as the intervention programme with the experimental group was completed, the control group would be given the opportunity to enjoy the same intervention, thus ensuring that all participants were engaged in a programme that proved beneficial to the participants. Also, in the RCT conducted by Wang and colleagues (2022), where the authors aimed to assess the effects of a PA programme on obesity, physical fitness and blood pressure in adolescents with IDD, two groups were made. The experimental group benefited from PA sessions while the control group did not benefit from any activity during the study, keeping only their usual tasks. Although it did not enjoy any activity, other than the usual ones during the investigation, it received the opportunity to perform the same PA programme as the experimental group once the investigation ended (Wang et al., 2022). However, knowing that regular PE decreases the risk of onset of metabolic and cardiovascular diseases (Yum, Lau, Poon & Ho, 2020; Ruegsegger & Booth, 2018) is it ethical to have a control group in the protocol under study?

In the study conducted by Yum, Lau, Poon and Hu (2020), with the purpose of understanding the effects of music therapy on social skills in children with Autism Spectrum Disorder (ASD) and IDD, the authors conducted a RCT with two intervention groups. The experimental group, who received weekly music therapy sessions and the control group who received sessions without music, but focused on social skills. In this way, the authors ensured that all participants enjoyed a beneficial therapy, with none of the groups being left without intervention. In addition, all participants gave oral consent to participate and a signed consent form was obtained from their guardians. The authors mention that all

procedures were reviewed and approved by the Human Research Ethics Committee of the Hong Kong University of Education in accordance with the Helsinki Declaration (Yum et al., 2020), thus ensuring the ethical and moral principles of research with humans.

In quasi-experimental studies and RCTs conducted with people with IDD, it was possible to verify that, in most of the cases mentioned (Vreuls et al., 2022; Wang et al., 2022; Yum et al., 2020; Mitchell et al., 2013), the control groups have the opportunity to use the same intervention after the end of the study or use a different intervention from the one the experimental group is receiving during the study. Keeping a control group active or a control group waiting for the end of the intervention to receive the same programme allows keeping their expectations and attention under control (Linquist et al., 2007; Street & Luoma, 2002). Despite the existence of numerous ethical issues regarding the use of these groups, in the analysed studies, most researchers favour good ethical conduct, trying to comply with their moral and ethical duties, favouring equal opportunities and transparency before, during and after the study.

As mentioned, the use of control groups in human research has proved to be useful to differentiate the results obtained and ensure, as far as possible, that they are due to the intervention programme applied and not to factors outside the research (Kinser & Robins, 2013; Street & Luoma, 2002). In the case of people with IDD, it was possible to verify that interventions within the scope of PA (Wang et al., 2022; Gómez et al., 2018; Mitchell et al., 2013), PE (Vreuls et al., 2022) and promotion of social skills (Yum et al., 2020) are beneficial to promote the QoL of this population. Thus, it seems pertinent to continue research in this area, in order to promote more reliable information that benefits interventions in this area. To this end, the use of control groups seems to be a methodologically more robust procedure; however, it is essential that researchers take into account the guidelines of the Declaration of Helsinki (World Medical Association, 1996) and follow all the procedures required by the ethics committees so that the studies are valid and provide benefits to those involved.

With this study, it was possible to conclude that promoting activities to the control group during the research seems to be a viable option (Vreuls et al., 2022; Yum et al., 2020). Nevertheless, the chance to enjoy the same intervention program as the experimental group should be offered to the control group if it is found to bring benefits to the health, well-being and QoL of the study population, thus ensuring equal opportunities (World Medical Association, 1996; Sarker, 2014).

Particularly regarding people with IDD, international ethical guideline (Dalton & McVilly, 2004) recommend (1) before initiating a research project, researchers should

ensure that, wherever possible, benefits to participants as a result of their involvement in the project can later be made available to any participants who were involved in a control or alternative treatment group (principle of justice) and (2) the selection of a control or comparison group be such that any potential disadvantage to persons assigned to those groups are minimized, and that mechanisms are in place to ensure that these persons have access to any benefits later established as a result of the study.

As future recommendations, we alert researchers to the need to consider all ethical issues inherent to research. It is essential to know the population with whom they will work and, given the characteristics of people with IDD, if necessary, to have the ability to adapt the information on the methods, procedures and objectives, to make sure that those involved understand all the steps of the research and that their consent is given based on their willingness to participate in the study and not by external influence. Another key issue that should be taken into consideration when conducting research studies with this population is the random allocation of volunteers. People with IDD have different characteristics, making them a very heterogeneous population group, thus it is essential that researchers take this into account when building the control and experimental groups, since the control groups must necessarily be composed of individuals with the same characteristics as the individuals belonging to the experimental group (Pithon, 2013).

While selecting the study sample (both experimental and control group) in exercise science research (Navalta, Stone & Lyons, 2019) researcher must guarantee that he/she does not discriminate anyone based on any characteristic including race, color, religious creed, ancestry, national origin, physical or mental disability, medical condition, marital status, sex, age, gender identity, sexual orientation, veteran status, or citizenship status.

The elaboration of RCTs or quasi-experimental studies seems to be an added value for scientific research, as they allow assessing the effects of an intervention programme in a detailed way, reducing the main extraneous variables. When control groups are used, it is fundamental to establish a methodology which privileges all the individuals who voluntarily accept to participate in the investigation. In this way, the use of a control group that can benefit from a programme that enhances their skills during the investigation, but which is different from that which is being investigated, seems more appropriate than a control group that does not benefit from any intervention during the investigation. Nevertheless, and understanding that there may not always be the means to do so, it is essential to guarantee the promotion of the intervention program studied to the control group, if it is found to bring benefits to the individuals.

4.5. Conclusions

When studies with control and experimental groups follow all the ethical indications and requirements, taking into consideration adequate risk management between benefits and harms, valid scientific basis, clarification about the study, signed informed consent and equal opportunities, they become an interesting answer in scientific research. However, taking into consideration the issue of equal opportunities, it seems essential that, before the research begins, researchers assess the possibilities of giving volunteers from the control group the opportunity to at least perform the same intervention as the experimental group after the research is finished. Indeed, everyone deserves to enjoy a therapy that is proven to be effective in promoting QoL, well-being and health.

In the case of studies involving people with IDD, there are aspects to be taken into account in order to ensure that all ethical procedures are effectively and validly ensured. In the case of informed consent, although it must be signed by the guardian and it is necessary to comply with this rule, there is an ethical obligation to ensure that the participants understand the procedures of the study in which they will participate, making it essential to adapt the language and use methodologies that facilitate their understanding. Furthermore, it is essential to have a thorough knowledge of the population belonging to the sample, and it is not considered ethical to hide details of the diagnosis in order to benefit the investigation. All information must be properly documented in the studies so that there are no doubts as to the veracity of the facts.

In summary, it seems that researchers have followed the main ethical standards, trying to mitigate any inequality that may arise, there are still some ethical challenges in the design and application of studies of this type, particularly in the population with IDD.

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Chapter 5 – Study IV: The Effects of a Multi-Sports Program on the Physical Fitness, Quality of Life, and Well-Being of People with Intellectual and Developmental Disabilities—A Study Protocol

Diz, S., Costa, A., Jacinto, M., Monteiro, D., Amaro, N., Rodrigues, F., Matos, R. & Antunes, R. (2024). "The Effects of a Multi-Sports Program on the Physical Fitness, Quality of Life, and Well-Being of People with Intellectual and Developmental Disabilities—A Study Protocol". *Disabilities,* 4, 741-753. http://dx.doi.org/10.3390/disabilities4040045

5.1. Abstract

We intend to develop an intervention program based on sports for people with IDD to analyse its effects on physical fitness, QoL, and well-being. The convenience sample will consist of at least 24 participants aged between 18 and 65, of both sexes, who are institutionalized with a previous diagnosis of IDD and no associated comorbidities (e.g., visual impairment or cerebral palsy). The participants will be divided into two groups: (i) the experimental group and (ii) the control group. The experimental group will have a weekly session, lasting 60 min, for 36 weeks. There will be a baseline assessment, a final assessment, and a follow-up assessment (three months after the end of the program). The results of this study are intended to contribute to the development of more assertive community interventions, based on sports, for the benefit of this population.

Keywords: intellectual developmental disabilities; sports; quality of life; well-being; physical fitness

5.2. Introduction

IDD is a developmental disorder that can range in severity: it can be mild, moderate, severe, or profound. It is described by limitations in intellectual functioning and adaptive behaviour, which are expressed in conceptual, practical, and social domains. These challenges typically emerge before the age of 22 (Schalock et al., 2021). This population often experiences limitations in motor performance, including difficulties with the control and manipulation of objects (Enkelaar et al., 2013), spatial cognition and right/left distinction (Carmeli et al., 2008), lower isometric strength, and lower limb strength (Pitetti & Yarmer, 2002). Additionally, they tend to have a higher Body Mass Index (BMI), obesity (Stanish & Temple, 2012), and lower cardiovascular fitness (Fernhall et al., 2001).

Despite the well-known positive benefits of PA, PE and sports in preventing diseases such as type II diabetes, hypertension, and obesity (Bartlo & Klein, 2011; Calders et al., 2011; Jacinto et al., 2023a), as well as reducing the risk of falls, reducing pain, improving joint range of motion, and achieving daily activities (Carmeli et al., 2005), individuals with IDD often have a sedentary lifestyle (Bartlo & Klein, 2011; Harris et al., 2019). Low levels of PA (Bossink et al., 2017; Pierce & Maher, 2020) tend to negatively affect their QoL (Cabeza-Ruiz et al., 2020).

QoL is a multidimensional construct encompassing eight domains, which apply to everyone, although they could diverge individually in terms of relative value and

importance. These domains include individual development; self-determination; rights; interpersonal relationships; social inclusion; and emotional, physical, and material well-being, which give rise to three factors: independence, participation, and well-being (Schalock et al., 2002; Simões et al., 2016). These domains are affected by personal characteristics and environmental factors that modify over time (Schalock et al., 2002, 2010). Well-being, one of the domains in this model, is a complex concept that can be examined from two complementary perspectives—objective and subjective well-being (Ryff et al., 2021). Subjective well-being includes two dimensions: an emotional dimension that concerns positive and negative affects, which represents the affect each individual manifests, as well as the prevalence of positive emotions over negative ones, and a cognitive dimension that involves life satisfaction, which agrees with the assessment the individual makes at any given moment concerning life satisfaction (Diener et al., 1985).

However, various studies have demonstrated that PA (Carbó-Carreté et al., 2016; Tomaszewski et al., 2022), PE (Carmeli et al., 2005, 2008), and sports (Crawford et al., 2015; Moltó & Bruna, 2017) can increase the perceptions of well-being and QoL of adults with IDD. Additionally, higher levels of functional capacity appear to be linked with higher QoL values (Williams et al., 2021).

In the context of PA, in Diz et al.'s study (Diz et al., 2021), where the effects of a PA intervention program on adaptive behaviour, physical fitness, and QoL in 16 adults with IDD were analysed, and the results pointed to significant differences in the total QoL value and two physical fitness variables in the experimental group. Similar outcomes were observed in a study by Tomaszewski and colleagues (Tomaszewski et al., 2022) in which the authors found, in a sample of 38 individuals with IDD, that the domain of competence and the total QoL score were significantly correlated with weekly step count.

Regarding PE, in Carmeli et al.'s study (Carmeli et al., 2005), after intervention programs, where one focused on balance and the other on muscle strengthening, lasting 6 months each with a sample of 22 participants with IDD, the results showed statistically significant differences in the self-concept of well-being in the experimental group, with a multiple regression analysis indicating positive relationships between balance, muscle strength, well-being, and physical training between the experimental and control groups (Carmeli et al., 2005). In addition, several systematic reviews have highlighted the benefits of PE programs in the population under study, highlighting reductions in fat mass and waist circumference and increased strength, balance, and fat-free mass as the main results (Jacinto et al., 2023b).

With regard to the practice of sports, in a cross-sectional study carried out by Crawford et al. (Crawford et al., 2015), when comparing the impacts that sports have on the psychosocial behaviour and QoL of 93 people with IDD, the authors found that Special Olympics athletes presented significant differences in the total QoL score and the leisure and socialization domains when compared with individuals who did not practice any type of sport or people who practiced PE/sports but not through the Special Olympics. Moltó and Bruma (Moltó & Bruna, 2017) aimed to analyse the association between sports and life satisfaction and identify which type of sport is the most associated with life satisfaction, and they found that participants who engaged in team sports reported higher satisfaction with their lives and greater appreciation of their living conditions.

Despite the increasing research interest in the relationship between the practice of PA, PE, and sports and the QoL and well-being of individuals with IDD, there remains a significant gap in studies examining the impact of these programs (sports-based programs) on the variables mentioned (Diz et al., 2021; Martin Ginis et al., 2021). Participation in programs that include diverse components, such as games, can encourage the frequency of practice and physical fitness (Farías-Valenzuela et al., 2022). Additionally, programs that involve social involvement (peers and teams) are often more motivating and facilitate practice (Bossink et al., 2017). However, there is a limited understanding of the impact that the practice of sports has on various variables, and there is still a shortage of longitudinal studies exploring its impact on the QoL, well-being, and physical fitness variables (Diz et al., 2021).

The sedentary lifestyle observed in this population under study is due to the presence of barriers that prevent or hinder the practice of PA, such as the short duration of intervention programs, reduced supply, poor adherence to sessions, as well as a lack of support from the community and a lack of motivation (Bossink et al., 2017; McGarty & Melville, 2018).

In this sense, considering the barriers and facilitators to the practice of PA by this population, it is becoming increasingly important for society to promote enjoyable programs that meet the interests and needs of individuals with IDD, keeping them motivated to practice PA in an attempt to broaden the offer, contribute to the decrease in sedentary lifestyles, and consequently promote the physical fitness, QoL, and well-being of this population.

Our study aims to analyse the effect of an intervention program based on sports on physical fitness, QoL, and well-being in institutionalized individuals with IDD. To this end, we intend to test the following hypotheses: (i) participants in the experimental group will

increase their physical fitness after 36 weeks of regular sports practice; (ii) participants in the experimental group will increase their QoL after 36 weeks of regular sports practice; (iii) participants in the experimental group will increase their levels of well-being after 36 weeks of regular sports practice; (iv) there will be a difference between the control group and the experimental group in levels of physical fitness after 36 weeks; (v) there will be a difference between the control group and the experimental group in QoL after 36 weeks; and (vi) there will be a difference between the control group and the experimental group in levels of well-being after 36 weeks.

5.3. Materials and Methods

5.3.1. Design

This study protocol describes a non-randomized experimental study consisting of 2 groups, an experimental (EG) and a waitlist control (WCG). The WCG will have the opportunity to participate in the same program provided to the experimental group after the study is completed.

Participants will be allocated to one of the two groups mentioned above: the EG group, where participants will have a weekly sport-based session lasting 60 min for 36 weeks, and the WCG participants will continue to do their usual activities but will not be allowed to take part in the program promoted to individuals belonging to the experimental group.

All participants will be assessed at three different times: before the start of the intervention program (baseline), after it finishes (final assessment), and three months after the end of the intervention program (follow-up assessment).

Figure 2 shows the timeline for the study design.

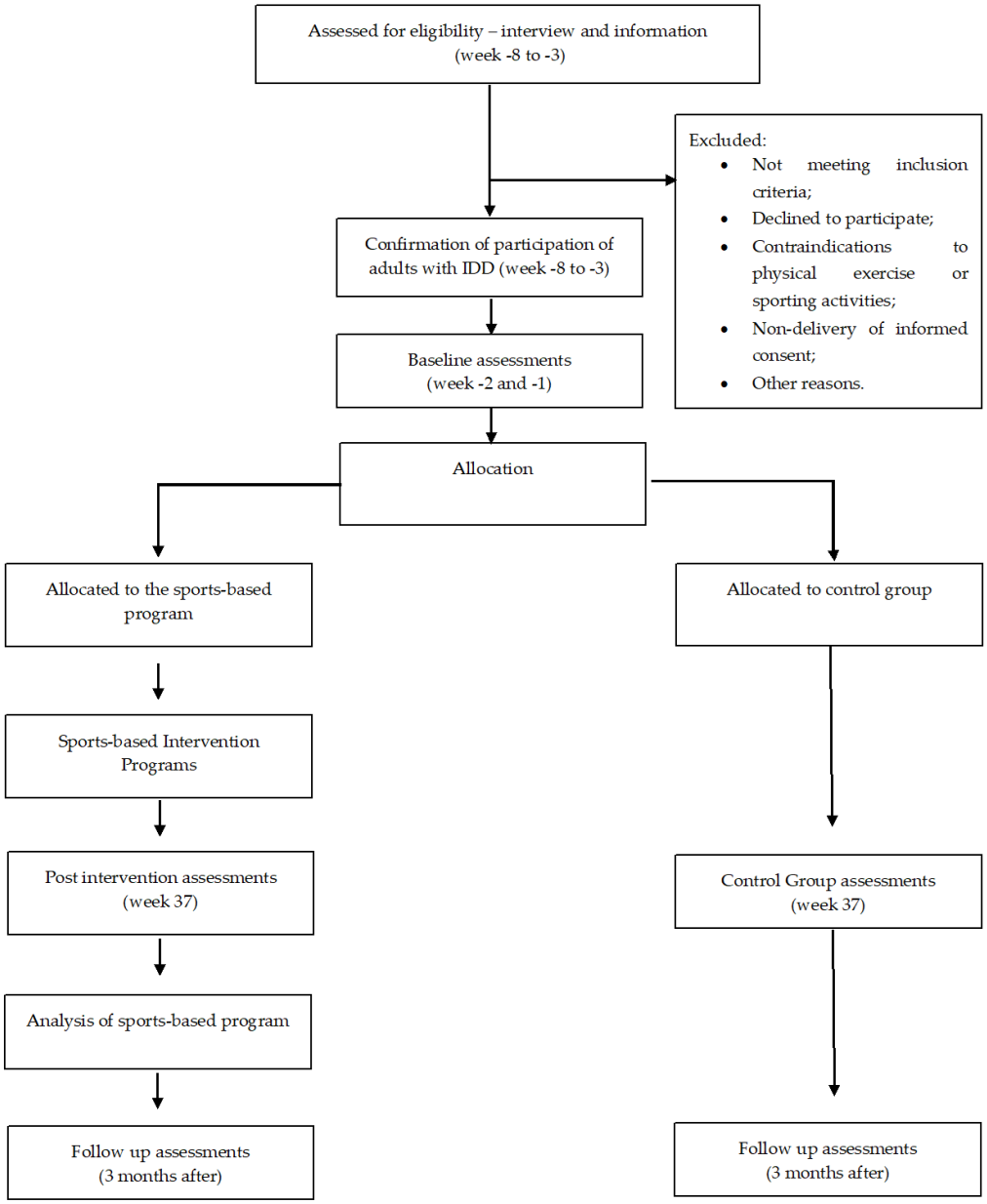

Figure 2 - Timeline for the study design.

5.3.2 Participants

The intervention program will involve individuals with a previous diagnosis of IDD, institutionalized in two care institutions in the Leiria region (Portugal).

The group of participants will be made up of a convenience sample of at least 24 participants in the total sample (experimental and control group with 12 participants each), aged between 18 and 65, of both sexes. Participants will be divided into two groups based on their interests and willingness to engage or not in a PE program. The number of

participants was defined using the G*Power (v. 3.1.9.7.) software considering that at least 14 subjects are needed to detect an average effect size of 0.55 ($\alpha = 0.05$, $1 - \beta = 0.95$), using the ANOVA repeated measures and the within–between interaction statistical test, in agreement with the literature. An effect size was chosen based on the effect of the intervention on strength and functional capacity variables (Obrusnikova et al., 2022a; Obrusnikova et al., 2022b). Considering the lack of studies investigating the impact of sport on the QoL and well-being of individuals with IDD, we used a reference with results in the other variables of interest to support the calculation of the sample's power.

The following inclusion criteria will be defined: (1) adults with IDD, diagnosed with mild, moderate, or severe IDD; (2) age is over 18; and (3) ability to carry out the assessments. The following exclusion criteria will also be defined: (1) comorbidities such as cerebral palsy, motor disability, blindness, and deafness; (2) contraindications for PE or sports; (3) inability to communicate; and (4) failure to provide signed informed consent.

5.3.3. Informed Consent

In addition to the explanations mentioned in the previous point, which will be carried out both with the management of the institutions and with the participants and their families/guardians, informed consent will also be given, written in simple and accessible language. This consent will contain all the information about the study, its objectives, development phases, possible risks, and benefits of participation, informing participants that they can withdraw at any time without repercussions and that participation will not compromise their physical or psychological integrity, and ensuring the confidentiality and anonymity of the data collected.

The informed consent form mentioned in the previous paragraph will be provided to the participant, their family members/guardians, and the management of the partner institutions. Participants will be given the necessary time to consider their decision to participate in the study and will then be asked to submit their informed consent (signed or not). At any time, participants may ask questions, and it will be the responsibility of the principal investigator to address and clarify any concerns.

5.3.4. Protocols

The aim of this intervention program is not only to understand how sports practice influences the physical fitness, QoL, and well-being of people with IDD, but also to address some of the previously mentioned barriers that prevent or limit participation. Additionally, the program aims to integrate factors that promote engagement, prioritizing the participants' interests and preferences to keep them motivated.

The sessions will be held in the morning at a pavilion in the city of Leiria, with each institution being responsible for transporting the participants. The sessions will be structured as follows: an initial talk and warm-up (using exercises related to the sport to be trained); a fundamental part (focused on critical components of the sport); a final game (formal game); and a free period (free moment for exploration of the materials related to different sports). At the end of each session, participants will be asked to give their feedback about the session and will be given a bottle cap, which they will be asked to place in one of three boxes (box with a green smiley face, box with a yellow smiley face, and box with a red smiley face), based on their own opinion of the session.

While a set of key components is suggested for each sport and a specific number of weeks, the planning is not fixed and can be adjusted to the characteristics of the individuals, considering the difficulty or ease with which they perform the proposed exercises and progress in acquiring the skills.

To monitor session intensity, the Modified Borg Scale (Borg, 1998) will be used. This scale measures the participant's perceived exertion during exercise and is an important tool for monitoring the intensity of physical effort (Borg, 1998). The Modified Borg Scale ranges from 0 to 10, where 0 represents no effort intensity and 10 represents maximum effort. At the end of each session, the scale will be applied to all participants so that we can monitor the intensity level of each session and ensure that it is close to the previously defined levels.

The sessions of the intervention program will be led and supervised by at least 3 technicians to guarantee the necessary support for all participants.

For more details regarding the intervention program, see table 4.

Table 4 - Intervention program protocol.

Sports Discipline	Technical Content	Critical Components	Intensities	Duration
Week – 0 and 1				
Playful Presentation Games	-	-	Light to Moderate (2-6)	60 minutes
Week 2; 3; 4; 5; 18, 19; 20; 21 and 34				
Handball	-Ball handling; -Shoot; -Passing and receiving; -Dribbling; -Defensive base position; -Offensive base position; -Formal play.	-Catching and handling the ball; -Shooting in support; -Shoulder pass and bounce pass; -Two-handed reception; -Progressive dribbling -Hand and arm placement	Moderate to Vigorous (4-8)	60 minutes
Week 6; 7; 8; 9; 22; 23; 24; 25 and 35				
Football	-Ball control and handling; -Passing and receiving; -Shooting on goal; -Dribbling; -Formal play.	-Ball control and handling; -Passing with the inside of the foot; -Passing and clearing; -Receiving with the inside of the foot; -Shooting with the inside of the foot; -Shooting with the instep; -Progressive dribbling; -Progressive dribbling with changes of direction	Moderate to Vigorous (4-8)	60 minutes
Week 10; 11; 12; 13; 26; 27; 28; 29 and 36				
Basketball	-Ball handling; -Passing and receiving; -Passing and clearing; -Throwing; -Dribbling; -Defensive base position; -Offensive base position; -Formal play.	-Catching and handling the ball; -Chest pass and bounce pass; -Passing and clearing; -Two-handed reception; -Support throw, free throw and pass throw; - Hand and arm placement; -Progressive dribbling, -Change of direction when dribbling and protective dribbling.	Moderate to Vigorous (4-8)	60 minutes
Week 14; 15; 16; 17; 30; 31; 32 and33				
Volleyball	-Ball handling; -Passing and receiving; -Service; -Attack; -Defensive base position; -Offensive base position; -Formal play.	-Touch support pass; -Overhead pass and headline; -Service underneath; -Rematch; -Positioning on the block.	Moderate to Vigorous (4-8)	60 minutes

5.3.5. Experimental Group

The intervention program will take place in the Inclusive Pavilion of the City of Leiria, which has been adapted for the sports practice by people with disabilities. The

sessions will consist of the following three distinct moments: 10 min of warm-up, with exercises related to the sport being trained; 40 min of the fundamental part, based on sports modalities; and 10 min of free time, where participants will have different materials associated with different sports available (e.g., basketballs, tennis rackets, footballs) and will be free to explore them. Finally, each participant will reflect on their participation at the end of each session.

5.3.6. Waitlist Control Group

Individuals in the WCG will be encouraged to maintain their usual daily activities and will not be allowed to take part in the intervention program sessions. After the end of the study, the WCG will have the opportunity to take part in the same program as that administered to the experimental group.

5.3.7. Assignment of Intervention and Blindness

Once informed consent has been signed by all parties involved and the baseline assessments have been completed, the participants will be allocated to the control and experimental groups.

Considering the nature of the intervention, once the baseline assessment is completed, it will not be possible to divide the sample randomly between the two groups and it will not be possible to hide the distribution by group from the participants and the principal investigator. However, to ensure the researchers are responsible for the assessments without this information, once the signed informed consent has been given, a code will be assigned to each participant, guaranteeing the subjects' anonymity. In this way, by keeping the same team of researchers carrying out the assessments at different times, the differences in procedures will be reduced.

5.3.8. Outcomes

The assessments will take place at the Lis Pavilion in Leiria in the morning. The researchers carrying out the assessments will not know what condition the participant is in (in the post-test). The participants will have eaten breakfast based on their characteristics and the need to take medication.

The Lis Pavilion will be home to the researchers, who will have the materials and space needed to carry out the assessments in an organized and comfortable way for the participants. In addition to the above, the Lis Pavilion also has a room where the QoL and well-being assessment scales will be applied individually and without distracting stimuli that could compromise the participant's performance.

Information regarding the procedures and objectives will be provided by the research team, who will also be available to clarify any doubts that may arise. Only the principal investigator will be aware of the allocation of subjects to groups, so the research team carrying out the assessments will be unaware of this information and will remain impartial.

5.4. Instruments

5.4.1. Anthropometry and Body Composition

To measure the participant's height, a stadiometer will be used. The participants will stand barefoot on the platform, leaning against the platform post, looking forward, with their upper limbs alongside their body.

Body composition will be calculated using bioimpedance equipment (Tanita BC-50, Arlington Heights, IL, USA) in which the participant must be barefoot, with their feet in contact with the electrodes. The following data will be collected from each participant: weight, BMI, muscle mass (kg), and fat mass (kg).

5.4.2. Handgrip

To measure upper limb strength, a handgrip test will be carried out using a hand dynamometer. Its reliability and validity have been confirmed by Cabeza-Ruiz et al. (Cabeza-Ruiz et al., 2020) and Oppewal and Hilgenkamp (Oppewal & Hilgenkamp, 2020) and the procedures recommended by the Brockport Fitness Test Manual (Winnick & Short, 2014) will be used.

To perform the test correctly, the participant must place their upper limbs alongside their body and perform the hand grip.

5.4.3. Functional Capacity

The Fullerton functional test battery (Rikli & Jones, 2013) will be used to assess the participants' physical fitness. Thus, to assess the strength and endurance of the lower limbs, the 'sit to stand' test will be carried out, which is feasible and reliable for people with IDD (Hilgenkamp et al., 2012; Wouters et al., 2017). To perform the test, the participant must be seated in the center of the chair, with their back straight, feet shoulder-width apart and fully supported on the floor. When the coach gives the 'start' signal, the participant must stand up, perform the maximum extension (vertical position), and then return to the starting position. The number of repetitions performed in 30 s will be counted and the participant is encouraged to complete as many repetitions as possible.

To assess aerobic endurance, the '6-minute walk test' will be used, which is valid and reliable for the study population (Nasuti et al., 2013). For the test to be carried out correctly, the participant must cover the maximum distance in 6 minutes without running, so at the 'start' signal, the participant is instructed to walk as quickly as possible around the distance marked with cones. If necessary, participants can stop and rest, then sit down and resume the route.

To assess physical mobility, namely speed, agility, and dynamic balance, the test evaluated by Cabeza-Ruiz et al. (Cabeza-Ruiz et al., 2020) will be used. The participant will start the test sitting on a chair, with their hands on their thighs and their feet fully flat on the floor. At the 'start' signal, they should get up from the chair and walk as quickly as possible (without running) around the cone that is 2.44 m away, return to the chair, and sit down. The participant should be informed that the test is assessed by calculating the time taken from getting up from the chair to sitting down again.

5.4.4. Quality of Life

QoL will be assessed using the Portuguese version of the Personal Outcomes Scale (Simões et al., 2016). This scale consists of two versions: self-report, answered by the participants, and report by third parties, professionals, or family members who have known the individual for at least 3 months in different contexts. The Personal Outcomes Scale covers eight domains, with five questions each, totalling forty questions. Each question has three Likert response options, such as often, sometimes, or never. This scale makes it possible, among other things, to assess the impact of interventions, providing crucial

information for improving their quality, as well as promoting credible and sustainable practices (Simões et al., 2016).

5.4.5. Well-Being

Two self-report scales will be used to assess well-being: the Satisfaction with Life Scale, Portuguese version (Neto, 1993), and the Positive and Negative Affect Schedule, Portuguese version (Antunes et al., 2020).

The Satisfaction with Life consists of five questions, each with seven possible answers ranging from 'totally disagree' to 'totally agree'.

The Positive and Negative Affect Scale consists of ten questions, with five answer options ranging from 'not at all or very slightly' to 'extremely'.

5.5. Procedures

As a first step, the principal investigator will explain the procedures and objectives of the study, as well as the potential benefits, risks, and time needed to carry out the project to each of the potential participants, their families/guardians, and the management of the institutions. Subsequently, participants who meet the study's inclusion criteria and wish to take part in the study, as well as their family members/guardians and the management of the institutions, will sign an informed consent form.

Once the informed consent forms have been obtained, an initial assessment of the participants will be carried out and they will be allocated (based on their interests and availability to be involved with PE programs) to the following groups: (i) the experimental group and (ii) the WCG. After the baseline assessment, the 36-week intervention program will begin. After this period, the final evaluation of the groups will be carried out by an evaluator who is not part of the group, and the same will happen for the follow-up evaluation, 3 months after the end of the program.

Participants must attend at least 75% of the sessions; otherwise, they will continue to benefit from the intervention plan but will not be considered for the study.

5.6. Statistical Analysis

Descriptive statistics will be used, and normality and homogeneity will be checked using the Shapiro–Wilk test and the Levene test, respectively. A mixed 2 × 3 analysis of variance (ANOVA) was conducted with the delivery method as the between groups (WCG and EG) factor and moments (baseline assessment, final assessment, follow-up assessment) as the within factor. Effect sizes were evaluated as trivial (0–0.19), small (0.20–0.49), medium (0.50–0.79), and large (0.80 and greater), as suggested by Cohen (Cohen, 1988). A p-value of <0.05 will be assumed. The data will be processed using the IBM SPSS Statistics v28 program.

5.7. Adverse Events

Considering that people with IDD tend to have a more sedentary lifestyle, which can contribute to early signs of fatigue or discomfort, a medical team from the institution will be available before, during, and after the intervention program to monitor participants' general health. If any signs of fatigue, injury, discomfort, or muscle pain happen during the intervention program or evaluation tests, the medical team will be ready to address these concerns and evaluate the participants' well-being.

The principal investigator, as well as any of the technicians accompanying the participants during the intervention program sessions, will be available to answer any questions, help, and advise the participants.

In the event of any adverse outcome, this will be recorded, described, and presented in future publications.

5.8. Participation Attendance/Adherence

Participants must attend and take part in at least 75% of the sessions to be considered for the data processing phase. The participation of everyone in the sessions will be recorded in green if the participant attends and participates in the session and in red if they do not attend or participate in the session.

5.9. Discussion

This study will allow us to verify the possible benefits of implementing a 36-week intervention program based on sports on the physical fitness, QoL, and well-being of people with IDD. It will also be an important tool for understanding the impact that detraining can have on physical fitness, QoL, and well-being.

Despite the lack of studies exploring the effect of practicing sports in this population, it is expected that the intervention will provide positive changes in the variables under study, considering other studies, with different populations, where it is possible to verify the positive impact of practicing sports in terms of physical fitness, QoL and well-being (Diaz et al., 2019; Ilhan et al., 2021; Pedersen et al., 2017). As verified in the pilot study carried out by Tomé et al. (Tomé et al., 2024), the authors analysed the effects of a PE program, which included components related to sports on the levels of autonomy, functionality in activities of daily living, and physical fitness of people with IDD. After the end of the intervention program, significant improvements were observed in functionality (self-report and proxy) and body composition variables, but not in physical fitness variables (Tomé et al., 2024). This lack of improvement may be attributed to the weekly frequency and short duration of the pilot project. However, the intervention program seems to have contributed positively to improving the perception of autonomy in activities of daily living and body composition (Tomé et al., 2024), serving as a good indicator for future research. In this context, the intervention program in this study will consist of a greater number of sessions and will take place over 36 weeks, will be exclusively based on sports, and will consider the participants' opinions throughout the sessions. This way, we intend to make the sessions as attractive as possible for participants, thus reducing the possibility of dropouts throughout the program.

As far as the WCG is concerned, no changes are expected in the variables analysed, since the participants will maintain their usual activities. It should be noted that if the intervention program is shown to be beneficial for the experimental group, the WCG will have the opportunity to benefit from the same intervention program after the end of the study. Participants in this study are not randomized to group, nor will we control for any baseline differences between groups. We acknowledge that this selection bias is a limitation that may result in differences being observed that are not real, either with an overestimation or underestimation of the benefit or harm.

The study we are about to initiate is crucial for the development of knowledge in this area and could be a starting point for further research in this area and an effective tool for reducing some of the barriers that hinder/make it impossible to practice PA (e.g., short

duration of intervention programmers, lack of motivation) (Bossink et al., 2017; McGarty & Melville, 2018). We intend to contribute with implications for practice, providing new interventions and strategies that could be effective and contribute to a paradigm change associated with the high levels of sedentary behaviour in the population under study. With the realization of this project, we hope to create useful and effective guidelines for physical education teachers and exercise technicians to help them promote the practice of sports as a way of developing physical fitness, reducing sedentary lifestyles, and, essentially, the QoL and well-being of this population.

5.10. Ethics and Dissemination

Any changes to the protocol will be agreed upon by the research team and formally communicated to the Ethics Committee of the University of Beira-Interior prior to their implementation (Ethics Committee Code No. CE-UBI-Pj-2023-061).

The sample will be made up of individuals aged between 18 and 65 with IDD who, due to the cognitive limitations associated with the diagnosis, may have difficulties understanding the informed consent form. Therefore, it will be written in simple, accessible language and given not only to the individuals eligible for this study but also to their carers/guardians. As such, it is necessary to guarantee that there will be no secondary gain on the part of the carer and that the opinion of the subject involved in this study will be taken into consideration.

Informed consent will include all clarifications about the study, its objectives, development phases, possible risks and benefits of participation, informing them that they can withdraw at any time without repercussions and that participation will not compromise their physical or psychological integrity, ensuring the confidentiality and anonymity of the data collected. In addition to informed consent, in this case, it is also necessary to obtain informed assent from the participants. This is an agreement to take part in scientific research, considering the existence of a lesser understanding of what is expected.

Each participant will be given a unique coded identification number to maintain their confidentiality, and all experimental data will be recorded using these codes.

The evaluated data will be collected and stored on a computer to which only the principal investigator will have access, and the data will be used exclusively for research purposes. The data will be kept for a period of 5 years after the end of the research and will then be permanently deleted.

After the end of this study, the control group will have the opportunity to take part in a program like the one administered to the experimental group.

The results obtained in this study will be published and communicated, regardless of the magnitude or direction of the effect. Communication with the scientific community will be carried out through participation in conferences and/or congresses.

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Chapter 6 – Study V: The effect of practising sports on the quality of life and well-being of people with intellectual and developmental disabilities

Diz, S., Jacinto, M., Costa, A. M., Matos, R., & Antunes, R. (2025). The effect of practising sports on the quality of life and well-being of people with intellectual and developmental disabilities. *International Journal of Developmental Disabilities*, 1–13. https://doi.org/10.1080/20473869.2025.2511674

6.1. Abstract

Background: the aim of this study was to analyse the effect of an intervention based on sports (one 60-minute session per week) for 36 weeks on the QoL and well-being of people with Intellectual and Developmental Disabilities. Method: 36 participants with Intellectual and Developmental Disabilities, institutionalised, divided into two groups: (i) experimental (EG), with 23 participants (M=37.26±13.84) and (ii) control (CG), with 13 individuals (M=38.31±; 14.22). The Personal Outcomes Scale, the Satisfaction with Life Scale and the Positive and Negative Affect Schedule were used to assess the variables of interest. Results: after the intervention programme, significant improvements were observed in the EG in the domains of self-determination (p=0.01), social inclusion (p=0.01) and physical well-being (p<0.01) of QoL and in satisfaction with life (p=0.02) and negative affect (p<0.01). Conclusion: the results seem to reinforce the importance that programmes based on the practice of sports can have on the QoL and well-being of this population.

Keywords: intellectual disability, sports, life satisfaction, affect, intervention.

6.2. Introduction

Individuals with Intellectual and Developmental Disabilities tend to present limitations in adaptive behaviour and intellectual functioning, which manifest in conceptual, practical, and social domains (Schalock et al., 2021). These originate by the age of 22 and vary in degrees of severity (Schalock et al., 2021). Despite the positive impact that PA and sports have in preventing numerous diseases (Bartlo and Klein, 2011; Calders et al., 2011), promoting physical fitness and supporting the successful performance of daily living activities (Carmeli et al., 2005), as well as enhancing emotional and physical well-being (Alesi & Pepi, 2015), individuals with Intellectual and Developmental Disabilities tend to lead a sedentary and inactive lifestyle. This lifestyle negatively affects their QoL (Cabeza-Ruiz et al., 2020). Among other reasons, sedentary behaviour and physical inactivity in this population are associated with barriers that hinder or prevent PA participation, such as limited availability of activities, lack of motivation and insufficient support from the community (Bossink et al., 2018).

QoL is a multidimensional phenomenon, consisting of essential domains that are influenced by personal characteristics and environmental factors (Schalock et al., 2010). These domains, although common to all individuals, may vary in importance depending on the value each person assigns to them (Schalock et al., 2010). Therefore, the conceptual model of QoL in Intellectual and Developmental Disabilities includes eight domains, which

are grouped into three factors: independence, participation, and well-being (Simões et al., 2016; Schalock &Verdugo, 2002). Its assessment enables, among other things, an understanding of an individual's satisfaction with their own life, evaluation of the effectiveness of strategies used, as well as interventions and theoretical models (Schalock & Verdugo, 2002). Consequently, this assessment supports professionals and researchers in guiding individuals toward the life they value and aspire to (Schalock & Verdugo, 2002). Furthermore, it allows us to understand the challenges and barriers faced by individuals with Intellectual and Developmental Disabilities, contributing to their resolution and improving public policies or service practices to better meet their needs and preferences (Jacinto et al., 2023).

Within the multidimensional model of QoL in Intellectual and Developmental Disabilities, well-being emerges as one of the three core factors, alongside independence and participation (Simões et al., 2016; Schalock & Verdugo, 2002). This concept, central to assessing QoL, is complex and can be examined through two complementary lenses: objective and subjective well-being (Ryff et al., 2021). Understanding it is critical for evaluating life satisfaction—a key domain in the QoL model—and for guiding interventions that foster a more meaningful life aligned with individual aspirations (Schalock & Verdugo, 2002; Jacinto et al., 2023). Subjective well-being encompasses the cognitive (satisfaction with life) and emotional (affects) evaluations a person makes about their own life (Diener, 2009) and is considered a long-term state that comprises these two dimensions (Diener et al., 1985). The concept of affect consists of two relatively independent dimensions (Tellegen et al., 1999; Watson et al., 1988): positive affect, which reflects the extent to which a person feels enthusiastic, active and alert; and negative affect, which reflects the degree to which a person feels distressed and lacks pleasurable feelings. In turn, life satisfaction refers to the satisfaction a person feels with their life overall or specifically within different domains (e.g., health, future security and relationships) (Diener et al., 2002). For this reason, it is also associated with the social and economic resources available to them (Cummins, 2005). This judgement depends on a comparison between current circumstances and what the individual defines as an appropriate standard (Diener et al., 1985; Pavot & Diener, 2008).

Despite the growing interest in the impact of PA, PE and sports on the QoL and well-being of people with Intellectual and Developmental Disabilities, there is a clear need for further research in this field, given the current scarcity of studies (Diz et al., 2024a). Especially studies that aim to analyse the effects that programmes based on sports modalities may have on the aforementioned variables (Diz et al., 2024a), because it's verified that individuals with IDD that perform sports activities may present greater possibilities of having the QoL (Ocete et al., 2025). As in the case in other studies carried

out with other populations, where it is possible to verify the positive impact of practising sports on QoL and well-being (e.g.: Ilhan et al., 2021).

Nevertheless, the low adherence of individuals with Intellectual and Developmental Disabilities to PA and PE (Gjestvang et al., 2020) is partly due to the lack of programmes adapted to their needs and goals, guided by properly trained professionals (Jacinto et al., 2021) and without a structured progression (Jeng et al., 2017; Obrusnikova et al., 2022). Additionally, the lack of motivation for participation (Bossink et al., 2018) has led the authors to develop an intervention programme based on sports modalities, adapted to the participants' needs, structured and delivered by specialised professionals with experience in the field. A programme aimed at addressing the identified barriers, prioritising the participants' interests and needs, as well as incorporating their feedback about the sessions, helping to keep them motivated and engaged. Furthermore, cross-sectional studies indicate that participation in sports modalities is associated with better well-being and QoL indicators (e.g., Mira et al., 2022; Crawford et al., 2015) in athletes with disabilities, which reinforces the need for more longitudinal studies in this area.

Therefore, with the present study, we aim to verify the following hypotheses: (i) The experimental group (EG) showed improved QoL values after 36 weeks of intervention, with regular participation (once per week) in sports modalities; (ii) The EG showed improved well-being values after 36 weeks of intervention, with regular participation (once per week) in sports modalities; (iii) A difference in QoL was observed between the control group (CG) and the EG after 36 weeks of intervention, with regular participation (once per week) in sports modalities; (iv) A difference in well-being was observed between the CG and the EG after 36 weeks of intervention, with regular participation (once per week) in sports modalities.

6.3. Materials and Methods

6.3.1. Study Design

The present study is a non-randomised experimental study consisting of two groups. The EG participated in a weekly session based on sports activities lasting 60 minutes, over 36 weeks and the CG carried out their daily activities without taking part in the weekly sessions provided to the EG.

Participants from both groups were assessed at two distinct times: before the start (week 0) and after the end (week 37) of the intervention programme.

6.3.2. Participants

This study involved individuals from two institutions located in the Leiria region, Portugal. The inclusion criteria for participation in this study were defined as follows: (1) diagnosis of Intellectual and Developmental Disabilities (mild or moderate); (2) age between 18 and 65 years; (3) ability to carry out the assessments; (4) attendance at a minimum of 75% of the sessions. The exclusion criteria were: (1) contraindications for engaging in PE or sports activities; (2) associated comorbidities (cerebral palsy, motor disabilities, blindness or deafness); (3) inability to communicate; (4) failure to provide a signed informed consent form.

The number of participants, consisting of a convenience sample, included 47 individuals: 32 in the EG and 15 in the CG. During the 36 weeks of intervention, 9 participants from the EG dropped out of the study. None of the dropouts were related to the intervention programme; 2 participants left due to hospitalisation, 2 for health reasons and the remaining participants left the institution they were part of. In the CG, 2 individuals were not included in the study as they did not attend the final assessments. Thus, the final sample for the present study consisted of 36 participants: 23 belonging to the EG and 13 belonging to the CG, as shown in the flowchart of participants (Figure 3). As mentioned in the study protocol (Diz et al., 2024b), the group of participants should have at least 24 individuals, a number calculated using the G*Power software, considering that at least 14 participants are needed to detect a medium effect size of 0.55 ($\alpha = .05$, $1 - \beta = 0.95$), using a repeated measures ANOVA statistical test, with pairwise interaction, in accordance with the literature.

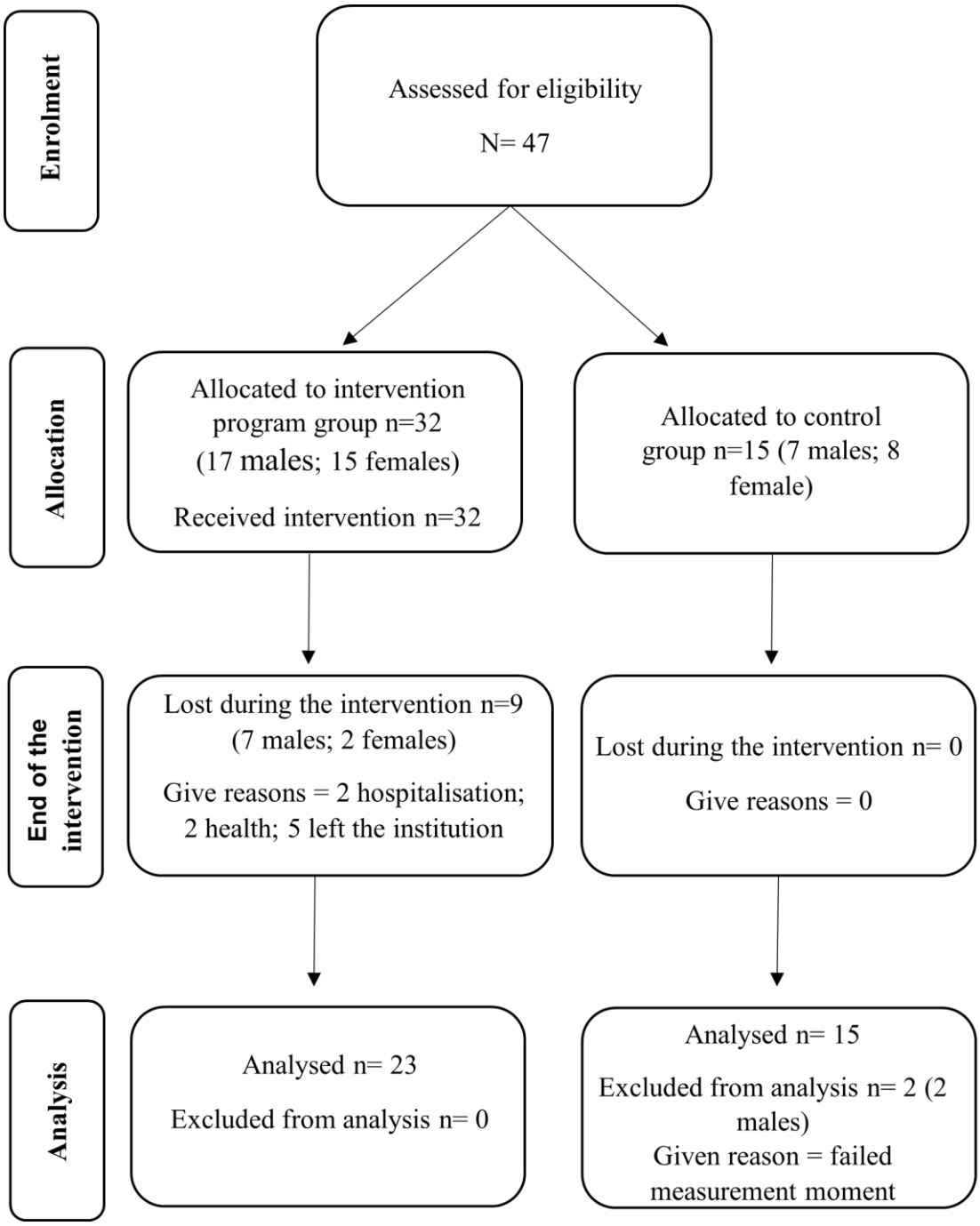

Figure 3 - Flowchart of participants

As mentioned in the inclusion criteria, participants in the EG were required to attend at least 75% of the sessions. Those who did not meet this requirement could continue attending the sessions but would not be included in the study. After the end of this study, the CG was offered the opportunity to participate in a programme identical to the one administered to the EG. Table 5 present the characteristics of participants.

Table 5 - Characteristics of participants

Groups	N	Age	Height	BMI
Experimental	23	37.26±13.84	159.14±11.11	26.11±5.27
Control	13	38.31±14.22	159.27±9.82	28.02±5.51

6.3.3. Instruments

Quality of life

The Personal Outcomes Scale (POS) (Simões et al., 2016) aims to assess the QoL of people with Intellectual and Developmental Disabilities and its application allows for the collection of essential information about the impact of interventions, enabling them to be improved (Simões et al., 2016). The scale is based on the conceptual model of eight domains which, when grouped together, give rise to three factors: "Independence," encompassing the domains of "Personal Development" and "Self-Determination"; "Social Participation," which includes the domains of "Interpersonal Relationships," "Social Inclusion," and "Rights"; and finally, the factor "Well-Being," comprising the domains of "Emotional Well-Being," "Physical Well-Being," and "Material Well-Being" (Simões et al., 2017).

The POS consists of two versions: the self-report version, answered by the participants, and the version reported by others, completed by professionals or family members who have known the individual for at least three months in different contexts. Each domain includes five questions, amounting to a total of forty questions, each with three Likert-type response options: frequently, sometimes, and never (Simões et al., 2016).

The internal consistency of the POS, analysed by the authors using Cronbach's alpha, showed values ranging from 0.75 to 0.91 (Simões & Santos, 2014; Simões et al., 2016; Simões et al., 2017) across the different domains of the scale, demonstrating good reliability.

Well-being

Well-being was assessed using the Portuguese versions of the following scales: the Satisfaction with Life Scale (SWLS) (Neto, 1993) and the Positive and Negative Affect Schedule (PANAS) (Antunes et al., 2020).

The SWLS aims to evaluate the individual's satisfaction with their own life. It consists of five questions, each with seven different response options, ranging from "totally disagree" to "totally agree" (Neto, 1993). The internal consistency of the Portuguese version

of the SWLS showed a Cronbach's alpha of 0.78, indicating adequate internal reliability (Neto, 1993).

The PANAS consists of ten questions, each with five response options ranging from "very slightly or not at all" to "extremely" (Antunes et al., 2020). The Cronbach's alpha, with values of 0.86 for positive affect and 0.89 for negative affect, demonstrated good internal consistency (Galinha & Pais-Ribeiro, 2005).

6.3.4. Procedures

The research team first contacted the institutions, where the objectives of the study were explained and any questions regarding the intervention programme were clarified. Participants who met the inclusion and exclusion criteria were contacted and all explanations were given to both potential participants and their families/guardians. The informed consent form, written in clear and accessible language, was provided. It included all relevant information about the study, including its objectives, stages of development and potential risks and benefits of participation, informing participants that they could withdraw at any time without consequences and that their participation would not compromise their physical or psychological integrity. The confidentiality and anonymity of the data collected were always guaranteed.

Considering their interest and willingness to participate or not in the intervention programme, the participant was allocated to one of two groups: control or experimental. Any questions that arose were the responsibility of the principal investigator to address and clarify any doubts.

All the participants were assessed in the morning, in an inclusive pavilion in the city of Leiria, adapted for the practice of sports by people with disabilities. The spacious area allowed the assessments to be organised in the most comfortable and private way possible for all participants, with a smaller, isolated and distraction-free room available where the participants completed the self-report assessment scales. To minimise procedural differences, the tests were always carried out by the same research team.

The information regarding the procedures and objectives of each test was provided by the researchers, who were present during the completion of the scales, available to answer any questions that might arise, ensuring the necessary support for their correct completion.

The intervention took place in the same sports pavilion and at the same time as the initial and final assessments, conducted by the research team, with each institution being responsible only for transporting the participants.

Further details about the study protocol can be analysed in the previous study conducted by the research team (Diz et al., 2024b).

6.3.5. Intervention

The intervention programme was conducted and supervised by three physical exercise technicians, with experience and expertise in working with people with disabilities.

Thus, the sessions were pre-planned and structured as follows: the session began with a conversation and warm-up (with exercises related to the sport to be practised); the main part (focused on critical components of the sport); final game (introduction to formal game) and the free period (a free time for exploring sports materials from various disciplines). The final part of the session was reserved for participants to provide their feedback on the session. They were given a bottle cap and asked to place in one of three boxes (a box with a green smile face, a box with a yellow smile face, and a box with a red smile face), based on their opinion of the session.

The exercises were explained clearly and succinctly, using demonstrations to facilitate understanding. Participants were always encouraged to perform the exercises and feedback was adjusted to ensure correctness during the execution. The Modified Borg Scale (Borg, 1998), which measures the participant's perception of effort during exercise, was applied in all sessions after the completion of the "final game." The Modified Borg Scale ranges from 0 to 10, where 0 represents no effort and 10 represents maximum effort. Additionally, the Talk Test was also used. This is a practical and validated test to estimate exercise intensity in both clinical and research contexts (Cowan et al., 2012; Foster et al., 2008; Persinger et al., 2004). For more information on the intervention programme, analyse Table 6 and consult the study protocol previously conducted by the research team (Diz et al., 2024b).

Table 6 - Intervention Programme Protocol.

Sports Discipline	Technical Content	Intensities	Duration
	Week – 0 and 1		
Playful Presentation Games		Light to Moderate (2-6)	60 minutes
	Week 2; 3; 4; 5; 18, 19; 20; 21 and 34		
Handball	-Ball handling; -Shoot; -Passing and receiving; -Dribbling; -Defensive base position; -Offensive base position; -Formal play.	Moderate to Vigorous (4-8)	60 minutes
	Week 6; 7; 8; 9; 22; 23; 24; 25 and 35		
Football	-Ball control and handling; -Passing and receiving; -Shooting on goal; -Dribbling; -Formal play.	Moderate to Vigorous (4-8)	60 minutes
	Week 10; 11; 12; 13; 26; 27; 28; 29 and 36		
Basketball	-Ball handling; -Passing and receiving; -Passing and clearing; -Throwing; -Dribbling; -Defensive base position; -Offensive base position; -Formal play.	Moderate to Vigorous (4-8)	60 minutes
	Week 14; 15; 16; 17; 30; 31; 32 and 33		
Volleyball	-Ball handling; -Passing and receiving; -Service; -Attack; -Defensive base position; -Offensive base position; -Formal play.	Moderate to Vigorous (4-8)	60 minutes

6.3.6. Statistical Analysis

Regarding the data analysis, we began by descriptively analysing the socio-demographic data, using mean values and frequency analysis. Initially, the normality of the

distribution of the variables was calculated using the Shapiro-Wilk test (n < 50). Descriptive analysis was then performed, using measures of central tendency and dispersion, including the median and interquartile range (IQR). To compare the EG and CG, and since the assumptions for the use of parametric statistics were not met, the non-parametric statistical technique Mann–Whitney U test was used. For the comparison between the two moments for the EG and CG (moment 0 and moment 1), we used non-parametric statistics, specifically the Wilcoxon test. For this analysis, a value of p< 0,05 was assumed to reject the null hypothesis (Ho, 2014). For data processing, the statistical software Statistical Package for the Social Sciences – SPSS (V.27.0).

6.4. Results

Table 7 shows the comparison between the CG and the EG at the pre-intervention moment.

Table 7 - Comparison of CG and EG (pre-intervention)

		Control Group		**Experimental Group**			
		Median	**IQR**	**Median**	**IQR**	***P***	***Z***
Subjective well-being	Satisfaction with Life	5.00	1.60	5.40	1.60	0.87	-0.18
	Positive Affect	3.00	0.60	3.60	1.40	0.10	-1.66
	Negative Affect	2.00	1.50	2.60	1.60	0.19	-1.32
Quality of Life	Personal Development	11.00	8	10.00	9.00	0.92	-0.10
	Self-determination	11.00	4	11.00	3.00	0.49	-0.70
	Interpersonal Relations	13.00	1	12.00	2.00	0.49	-0.71
	Social Inclusion	12.00	2	12.00	3.00	0.42	-0.85
	Rights	10.00	4	10.00	3.00	0.40	-0.88
	Emotional Well-being	13.00	2	13.00	2.00	0.31	-1.07
	Physical Well-being	11.00	3	13.00	2.00	0.15	-1.47
	Material Well-being	10.00	3	10.00	3.00	0.90	-0.15

As we can analyse in Table 7, no statistically significant differences were observed between the EG and the CG in the baseline assessment.

Table 8 presents the comparison between the CG and the EG at the post-intervention stage, where statistically significant differences can be found in different variables.

Table 8 - Comparison of CG and EG (post-intervention)

		Control Grup		Experimental Grup				
		Median	**IQR**	**Median**	**IQR**	***P***	***Z***	***r***
Subjective Well-being	Satisfaction with Life	5.00	1.40	5.80	1.00	**<0.01***	**-3.23**	**0.538**
	Positive Affect	3.40	0.90	4.00	1.00	**0.01***	**-2.95**	**0.492**
	Negative Affect	2.20	1.40	1.80	0.80	0.43	-0.81	0.135
Quality of Life	Personal Development	10.00	5	11.00	5.00	0.60	-0.53	0.088
	Self-determination	12.00	3	13.00	3.00	0.33	-1.01	0.168
	Interpersonal Relations	12.00	3	13.00	2.00	0.17	-1.42	0.237
	Social Inclusion	11.00	2	12.00	2.00	**0.02***	**-2.36**	**0.393**
	Rights	10.00	5	12.00	5.00	0.09	-1.71	0.285
	Emotional Well-being	13.00	2	14.00	2.00	**0.04***	**-2.15**	**0.358**
	Physical Well-being	12.00	2	14.00	2.00	**<0.01***	**-4.47**	**0.745**
	Material Well-being	10.00	3	11.00	2.00	0.17	-1.42	0.237

Note: r – Effect size

Contrary to what was observed in the pre-intervention phase (baseline assessment), where no differences were found in any of the variables between the groups (control vs experimental), in the post-intervention phase the EG showed statistically higher values in several well-being and QoL variables, namely: life satisfaction ($p<0.01$; $r=0.538$), with a large effect size; positive affect ($p=0.01$; $r=0.492$), with a medium effect size and in the dimensions of social inclusion ($p=0.02$; $r=0.393$) and emotional well-being ($p=0.04$; $r=0.358$), both with a medium effect size, as well as physical well-being ($p<0.01$; $r=0.745$), with a large effect size (Table 8).

Table 9 represents the comparison between the pre- and post-intervention moments for the EG.

Table 9 - Comparison between pre- and post-intervention moments in the EG

		Moment 0 (pre-intervention)		Moment 1 (post-intervention)				
		Median	**IQR**	**Median**	**IQR**	***P***	***Z***	***r***
Subjective Well-being	Satisfaction with Life	5.40	1.60	5.80	1.00	**0.02***	**-2.43**	**0.507**
	Positive Affect	3.60	1.40	4.00	1.00	0.09	-1.70	0.354
	Negative Affect	2.60	1.60	1.80	0.80	**<0.01***	**-3.01**	**0.628**
Quality of Life	Personal Development	10.00	9.00	11.00	5.00	0.29	-1.06	0.221
	Self-determination	11.00	3.00	13.00	3.00	**0.01***	**-2.59**	**0.540**
	Interpersonal Relations	12.00	2.00	13.00	2.00	0,07	-1.83	0.382
	Social Inclusion	12.00	3.00	12.00	2.00	**0.01***	**-2.89**	**0.603**
	Rights	10.00	3.00	12.00	5.00	0.32	-0.99	0.206
	Emotional Well-being	13.00	2.00	14.00	2.00	0.12	-1.58	0.329
	Physical Well-being	13.00	2.00	14.00	2.00	**<0.01***	**-3.76**	**0.784**
	Material Well-being	10.00	3.00	11.00	2.00	0.07	-1.80	0.375

Note: r – Effect size

Regarding the comparison between the pre- and post-intervention moments (Table 9), the EG showed statistically significant improvements in the following subjective well-being variables: satisfaction with life (p=0.02; r=0.507) and negative affect (p<0.01; r=0.628). Additionally, significant improvements were observed in the QoL dimensions of self-determination (p=0.01; r=0.540), social inclusion (p=0.01; r=0.603), and physical well-being (p<0.01; r=0.784), all with a large effect size.

Table 10 presents the results of the comparison between the pre- and post-intervention phases in the CG.

Table 10 - Comparison between pre- and post-intervention moments in the CG

		Moment 0 (pre-intervention)		**Moment 1 (post-intervention)**				
		Median	**IQR**	**Median**	**IQR**	***P***	***Z***	***r***
Subjective Well-being	Satisfaction with Life	5,00	1,60	5,00	1,40	0,21	-1,26	0,349
	Positive Affect	3,00	0,60	3,40	0,90	0,29	-1,06	0,294
	Negative Affect	2,00	1,50	2,20	1,40	0,25	-1,15	0,319
Quality of Life	Personal Development	11,00	8,00	10,00	5,00	0,48	-0,71	0,197
	Self-determination	11,00	4,00	12,00	3,00	0,94	-0,07	0,019
	Interpersonal Relations	13,00	1,00	12,00	3,00	0,20	-1,29	0,358
	Social Inclusion	12,00	2,00	12,00	2,00	0,33	-0,97	0,269
	Rights	10,00	4,00	10,00	5,00	0,52	-0,64	0,178
	Emotional Well-being	13,00	2,00	13,00	2,00	0,79	-0,26	0,072
	Physical Well-being	11,00	3,00	12,00	2,00	0,92	-0,11	0,031
	Material Well-being	10,00	3,00	10,00	3,00	0,83	-0,21	0,058

Note: r – Effect size

As observed in Table 10, the comparison between the pre- and post-intervention moments for the CG shows no differences in any of the variables analysed.

To assess participants' satisfaction with the sessions, each participant was given a bottle cap and asked to place it in one of three boxes: a box with a green smile face, a box with a yellow smile face and a box with a red smile face, according to their opinion of the session. The results of the satisfaction assessment indicate that, throughout the intervention programme, 94.10% of participants expressed high satisfaction with the sessions, 4.42% reported moderate satisfaction and only 1,48% did not enjoy the sessions. These results suggest that participants' feedback on the sessions was very positive.

6.5. Discussion

The aim of this study was to analyse the effect of a 36-week sports-based programme on the QoL and well-being of people with Intellectual and Developmental Disabilities.

According to the results obtained, in the post-intervention phase, participants in the EG showed significant improvements in life satisfaction and positive affect of well-being and social inclusion, emotional well-being and physical well-being of QoL. In contrast, no statistically significant differences were observed in the CG. The same was verified when comparing the two moments (moment 0 and moment 1) in the EG, which demonstrated significant improvements in life satisfaction and negative affect in the well-being variables and in the domains of self-determination, social inclusion and physical well-being belonging to QoL. The CG did not show any improvements in well-being or QoL variables. These findings suggest that practising sports seems to have a positive influence on the well-being and QoL of individuals with Intellectual and Developmental Disabilities.

These results appear to confirm the initial hypotheses, highlighting that: (i) the EG showed improved QoL values after 36 weeks of intervention, with regular participation (once per week) in sports modalities; (ii) the EG showed improved well-being values after 36 weeks of intervention, with regular participation (once per week) in sports modalities; (iii) a difference in QoL was observed between the CG and the EG after 36 weeks of intervention, with regular participation (once per week) in sports modalities; (iv) a difference in well-being was observed between the CG and the EG after 36 weeks of intervention, with regular participation (once per week) in sports modalities.

Hutzler and Korsensky (2010), in their systematic review study, found that successful PE interventions for individuals with Intellectual and Developmental Disabilities included group exercises conducted in a collaborative environment. Furthermore, research has shown that people with Intellectual and Developmental Disabilities enjoy practising PA, PE, and/or sports in inclusive environments with people without disabilities (Lante et al., 2011). The results obtained in the domain of social inclusion appear to be corroborated by other studies involving individuals with Intellectual and Developmental Disabilities, where PA sessions were implemented, and significant improvements were found in the social inclusion domain (Diz et al., 2021). Similarly, in a study by Carmeli et al. (2008), the implementation of a PE programme resulted in statistically significant differences between the CG and EG in the domain of social inclusion, as confirmed by variance analysis. In this sense, the way the intervention programme was structured, based on team sports, where interaction and collaboration were privileged, may have contributed to the improvement in

social inclusion. Additionally, the fact that the sessions were held in a sports hall within the community and with the participation, in different sessions, of university students who carried out the proposed exercises with the participants, promoting social interaction and inclusion, may also have been factors that contributed to the improvement shown.

Self-determination is a human right that invokes respect for the self-dignity and individual autonomy of all people (United Nations, 2016). However, partly due to overprotection by caregivers, we haven't always seen this right respected in the population with disabilities (Skarstad, 2018; Santos & Morato, 2012). Overprotectiveness and the devaluation of individuals' abilities, along with an emphasis on their difficulties, hinder the opportunities for learning and the development of essential skills for autonomy (e.g., Santos & Morato, 2012). The significant difference observed in the self-determination domain in the EG may be related to the way the sessions were structured, allowing participants to have an active voice during the sessions, with time reserved for them to choose which type of activity/sport they wanted to engage in and having the opportunity to evaluate the sessions autonomously, free from external influence. It is also assumed that the stimulation of self-efficacy may have led to greater confidence and security in their own abilities (Jo et al., 2018), which may have contributed to the significant improvement in self-determination. Supporting these findings is the study by Franco et al. (2023), which aimed to analyse the relationship between QoL and the practice of PA and sports in individuals with Intellectual and Developmental Disabilities. By comparing participants who did not engage in PA with those who did, the authors found statistically significant differences in self-determination among those who participated in PA or sports (Franco et al., 2023). They also observed that individuals with Intellectual and Developmental Disabilities who practiced PA or sports in an inclusive way had significantly higher scores in the self-determination domain of QoL (Franco et al., 2023). Furthermore, in the study by Carbó-Carreté et al. (2016), which wanted to analyse the effect of PA on each of the eight QoL domains and the three QoL factors, the authors obtained high values for self-determination ($p < 0.001$).

Regarding the statistically significant differences observed in the domains of physical well-being and emotional well-being, when comparing groups and when comparing moments (moment 0 vs moment 1), these can be explained by the positive influence that the practising of PA, PE and sport have on health and functional capacity, as well as improving sleep, reducing depressive symptoms and anxiety (Mahindru et al., 2023).

The results obtained align with those of the study by Carbó-Carreté et al. (2016), where the authors aimed to analyse the effect of PA practice on each of the eight domains of QoL and on the three factors of QoL and found positive values for physical well-being

($p<0.001$) and emotional well-being ($p<0.001$). This was also confirmed in the study by Jacinto et al. (2024), where after a 24-week outdoor PE intervention programme, they observed statistically significant differences in physical well-being ($t=2.762$; $p=0.017$; $\eta^2=0.545$) in adults with Intellectual and Developmental Disabilities, which could be related to the exposure to nature during the intervention programme.

Further supporting the obtained results are two studies conducted with children with Intellectual and Developmental Disabilities. In the study by Ozkan and Kate (2021), the authors found statistically significant differences in physical well-being ($p=0.028$) and emotional well-being ($p=0.002$), which may be associated to improvements in motor skills. Also, the study carried by Snapp et al. (2020) showed statistically significant differences in physical well-being ($\alpha=0.82$), these improvements may be related to the development of fundamental motor skills during the intervention programme, which contributed to the increase in PA levels and consequently to the physical fitness of the participants (Snapp et al., 2020). Regarding emotional well-being, Snapp et al. (2020) also found statistically significant differences ($\alpha=0.85$), suggesting that positive social interactions between peers, participants and coaches may explain this improvement. Furthermore, the safe space created for the sessions may have contributed to the enhancement of emotional well-being (Snapp et al., 2020).

Various studies have indicated that Paralympic athletes tend to report higher levels of subjective well-being and greater degree of functionality when compared to their peers (Hammond, 2014). They also report high levels of life satisfaction, high positive affect and low negative affect (Mira et al., 2022). A study conducted by Silva et al. (2021) highlighted the positive relationship between subjective well-being and sports participation in athletes with disabilities, showing that subjective well-being is positively affected by sports participation.

In order to analyse the relationship between sports participation and life satisfaction and to understand which type of sports practice is most associated with life satisfaction, Moltó and Bruna (2017) found that participants with Intellectual and Developmental Disabilities who engage in team sports are more satisfied with their lives ($p=-2.06$; $r=0.58$) and value their living conditions more ($p=-2.28$; $r=0.59$) compared to those with Intellectual and Developmental Disabilities who do not engage in any sport or those who practice individual sports. Additionally, in a study conducted by Carmeli et al. (2008), at the end of the PE intervention programme, the authors observed differences in the perception of well-being among the EG participants. A similar result was found in a study by Carmeli et al. (2005), where participants in two intervention groups, who engaged in

different PE programmes, showed improvements in their self-concept of well-being (Group A: p=0.05; Group B: p=0.05). In a study with people with motor disabilities, Yazicioglu et al. (2012) using the SWLS, to compare the life satisfaction of active and inactive individuals with motor disabilities, found statistically significant differences for the active group (p=0.05). The results we obtained are in line with those presented above, demonstrating that the implemented programme contributed to promoting subjective well-being, particularly satisfaction with life, positive affect and negative affect. These results may be related to the fact that the intervention programme focused on collective sports, prioritising social interactions, whether between participants, coaches, or guests, helping to reduce feelings of distress and fear while increasing feelings of enjoyment and enthusiasm for life.

The selection of sports in these programmes must take into account the specific characteristics of the population with IDD, as well as the desired objectives. Team sports, such as football, basketball or handball adapted for participants with IDD, promote not only physical fitness, but also the development of social skills, such as co-operation, communication and a sense of belonging - critical factors for QoL in this population. In addition, the group dynamics inherent in these sports can reduce social isolation and increase motivation for regular practice (Shields et al., 2012).

These programs are essential to help reduce the barriers that prevent and/or hinder the practice of PA and sport in this population, promoting their true inclusion in society. Scientific evidence shows that structured interventions, led by qualified professionals and focused on the individual interests and needs of the participants, can not only reduce sedentary lifestyles among people with IDD, but also improve their cardiovascular health, motor skills, self-confidence and social interaction (Ocete et al., 2024). In addition, regular participation in adapted PA is associated with a reduction in frequent comorbidities in this population, such as obesity, diabetes and anxiety disorders. In this sense, the implementation of robust, multisectoral public policies - involving education, health and social action - is crucial to encourage, support and promote the implementation of these programs. Such policies should include adequate funding, specialized training for professionals, adaptation of infrastructures and awareness campaigns that combat stigma and discrimination. The integration of evidence-based strategies, such as motivational coaching models and inclusive practices in school and community contexts, can boost results. In the long term, these measures will not only contribute to improving the QoL and well-being of people with IDD but will also bring economic benefits to health and social systems, reducing costs with treatments for preventable diseases. Therefore, investing in the promotion of adapted AD is not only a question of equity, but also of public health and social sustainability.

6.6. Limitations and Future Recommendations

This study, like any other of this nature, has some limitations that should be taken into consideration. Notably, the weekly frequency of the sessions. Despite the long duration of the programme, logistical and human resource constraints prevented sessions from being held more frequently. For future studies, we recommend that programmes of this nature hold at least biweekly sessions. It is worth mentioning that the sample consisted of institutionalised people with Intellectual and Developmental Disabilities, who also participated in other activities promoted by the institution, making it not possible to control the amount of PA practiced outside of the intervention programme. Future studies should also take a closer look at the differences in the impact of the programme according to variables such as gender, age, IQ, functionality or type of previous experience in sport, to concentrate the transfer of results and facilitate transfer to other contexts.

Additionally, there is a notable scarcity of studies exploring the impact of sport-based programmes on the QoL and well-being of individuals with Intellectual and Developmental Disabilities, so longitudinal and follow-up studies are suggested to contribute to the research, with representative samples that include various degrees of Intellectual and Developmental Disabilities severity. This study also seems to reinforce the role of sports practice, particularly in the well-being and QoL individuals with Intellectual and Developmental Disabilities. It is therefore essential that institutions find solutions to make such programmes available. Similarly, it is important that professionals working in these contexts with this population are able to monitor the effect of PA, PE and sports practice on participants' QoL and well-being.

6.7. Conclusion

The results of this study reinforce the idea that a programme based on the practice of sports, adapted to the needs and interests of individuals and implemented regularly, can contribute to improving the QoL and well-being of institutionalised people with Intellectual and Developmental Disabilities.

This study aims to contribute to scientific progress in the area, not only by demonstrating that the practice of sports can also bring such benefits, but also by adopting a different approach that prioritises the interests and preferences of the participants, making them an active part of the planning and evaluation of the sessions.

The results obtained highlight the positive impact that an intervention programme based on sports, lasting 36 weeks, adjusted to the needs and interests of individuals and implemented regularly, appears to have on the QoL and well-being of the participants. Significant differences were observed in the domains of self-determination, social inclusion, physical and emotional well-being of QoL and satisfaction with life, positive affect and negative affect of well-being. The high level of adherence to the programme contrasts with data from other studies, which report low participation of individuals with Intellectual and Developmental Disabilities in PA and PE intervention programmes. This evidence could be a positive indicator for PE professionals who want to adapt their interventions to include a greater number of participants, helping to reduce the sedentary behaviour associated with this population and promoting their QoL and well-being.

The results obtained from the assessment of participants satisfaction suggest that the vast majority enjoyed the sessions, which may have contributed to their increased motivation and, consequently, to the low drop-out rate, considering that none of the participants who left the intervention did so because of the programme.

In summary, this study reinforces the relevance of personalised and continuously implemented programmes as an effective strategy for improving the QoL and well-being of people with Intellectual and Developmental Disabilities, paving the way for future research to further explore these findings.

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Chapter 7 – Study VI: The effect of practising sports on the body composition and physical fitness of people with intellectual and developmental disabilities

Diz, S., Jacinto, M., Costa, A., Matos, R., Monteiro, D., Teixeira, J. & Antunes, R. (Under Review). The effect of practising sports on the body composition and physical fitness of people with intellectual and developmental disabilities. *Frontiers in Psychology*

7.1. Abstract

The aim of this study was to analyse the effect of a sport-based intervention, with weekly 60-minute sessions over 36 weeks, on the body composition and functional physical fitness of people with IDD. The sample consisted of 36 institutionalised participants with IDD, divided into two groups: experimental group with 23 participants (M=37.26; SD=13.84) and control group with 13 individuals (M=38.31; SD=14.22). A stadiometer, bioimpedance equipment and the Hand Grip, Sit and Stand, Timed Up and Go and 6 Minute Walk tests were used to assess the variables of interest. The experimental group showed statistically significant values in body mass index (p=0.01; r=0.301), muscle mass (p<0.01; r=0.431), Sit and Stand Test (p=0.01; r=0.324) and 6 Minute Walk Test (p<0.01; r=0.399). The results suggest that long-term programmes based on the practice of sports can bring benefits to the body composition and functional physical fitness of adults with IDD.

Keywords: intellectual disability, sedentary lifestyle; sports; physical fitness; body composition

7.2. Introduction

IDD is defined as a developmental disorder characterised by limitations in intellectual functioning and adaptive behaviour, with an impact on conceptual, practical and social domains (Schalock et al., 2021). IDD manifests itself by the age of 22 and can vary in severity from mild to profound (Schalock et al., 2021). In addition, people with IDD tend to have difficulties in executive functioning (Rodrigues et al., 2019) and motor performance, namely mobility limitations (Cleaver et al., 2009) resulting from lower tonic and muscular performance, associated with sensory deficits and slower and more imprecise motor responses (Carmeli et al., 2008), which compromise their autonomy in activities of daily living and social participation (Enkelaar et al., 2013).

At the same time, there is a high prevalence of comorbidities such as overweight/obesity, type II diabetes, hypertension and cardiovascular diseases (Calders et al., 2011; O'Leary et al., 2018), resulting from risk behaviours such as a sedentary lifestyle (Bergström et al., 2013; O'Leary et al., 2018) and reduced PA (Bossink et al., 2017; Pierce & Maher, 2020). These behaviours contribute to low levels of physical fitness, namely reduced levels of strength, aerobic capacity, balance and flexibility (Wouters et al., 2017) with negative consequences for walking (Cleaver et al., 2009), postural control (Lahtinen et al., 2007), manipulation of objects (Enkelaar et al., 2013) and consequently success in performing activities of daily living (Oppewal et al., 2014). This decrease in muscle strength,

especially in the lower limbs, is closely associated with a decline in physical and functional capacity (Mendonca et al., 2013).

The low adherence of people with IDD to PA and PE programmes is partly a consequence of the lack of programmes adapted to the needs and interests of this population, as well as the absence of structured progression in activities (Obrusnikova et al., 2022) and the lack of guidance from qualified professionals with experience in the field (Jacinto et al., 2021). In addition, the lack of motivation for regular practice is also a major obstacle (Bossink et al., 2017), highlighting the need for more participant-centred approaches. The short duration of intervention programmes and their discontinuity are also identified as barriers to participation and the effectiveness of interventions (Burns et al., 2024), which can compromise participants' motivation and involvement. Scientific evidence suggests that longer-lasting and more structured interventions tend to promote greater adherence and be more successful (Burns et al., 2024).

Scientific evidence has highlighted the benefits of PA and PE in the prevention and control of various chronic diseases (Calders et al., 2011), as well as in improving physical fitness, namely improvements in lower limb strength, cardiorespiratory fitness (Diz et al., 2021; Jacinto et al., 2023a; Jacinto et al., 2023b; Obrusnikova et al., 2021) and body composition, decreasing fat mass and increasing muscle mass (Jacinto et al., 2023a; Obrusnikova et al., 2021). Even though research into the practice of sports in this population is limited (Diz et al., 2024a), studies carried out with other populations (e.g.: elderly; visually impaired) show similar benefits (Pedersen et al., 2017).

In this context, the authors have developed a sports-based intervention programme that is structured, adapted to the characteristics and interests of the participants and led by professionals with specialised training and experience in the field. This programme seeks to respond to the barriers already identified, prioritising the participants' preferences and needs, including their opinion on the sessions, with the aim of maintaining motivation and involvement over time.

The aim of this study is to evaluate the effect of a programme based on the practice of sports once a week for 36 weeks on the body composition and functional physical fitness of people with IDD. Thus, the authors intend to verify the following hypotheses: (i) the experimental group (EG) showed improvements in body composition after 36 weeks of intervention, with regular practice of sports; (ii) the EG showed improvements in functional physical fitness after 36 weeks of intervention, with regular practice of sports; (iii) there was a difference between the control group (CG) and the EG in body composition after 36 weeks of intervention, with regular practice of sports; (iv) there was a difference between the CG

and the EG in functional physical fitness after 36 weeks of intervention, with regular practice of sports.

7.3. Materials and Methods

7.3.1. Study Design

This is a non-randomised experimental study made up of two groups. The EG took part in a weekly 60-minute sports-based session over 36 weeks and the CG maintained their usual daily activities without taking part in the sessions organised for the EG.

The participants in the EG and CG were assessed at two different times, before the start of the intervention programme (week 0) and after its conclusion (week 37).

7.3.2. Participants

This study involved people with a diagnosis of IDD who were institutionalised in two institutions in the region of Leiria, Portugal.

Eligibility criteria were defined for inclusion in the sample, namely: (1) clinical diagnosis of IDD; (2) age between 18 and 65; (3) ability to carry out the assessment procedures and (4) attendance at least 75% of the sessions. Exclusion criteria included: (1) medical contraindications for practising sports or PE (e.g. uncontrolled cardiovascular and pulmonary diseases); (2) presence of comorbidities such as cerebral palsy, motor disability, blindness or deafness; (3) absence of functional communication skills and (4) failure to provide a duly signed informed consent form.

It should be noted that if participants in the EG did not attend at least 75% of the sessions, as stipulated in the above criteria, they would not be considered for the study, although they could continue to take part in the intervention programme. It should also be mentioned that after the end of the study, the CG were given the opportunity to take part in an intervention programme identical to the one applied to the EG.

The convenience sample was initially composed of 47 participants, 32 of which were in the EG and 15 in the CG. The difference in numbers between the two groups is related to the fact that most participants showed an interest in taking part in the intervention.

During the 36 weeks of the intervention, 9 members of the EG dropped out of the study for reasons unrelated to the programme, two participants were hospitalised, two had

health problems and the rest were no longer affiliated with their respective institutions. In the CG, two participants didn't complete the final assessments and were therefore excluded from the final sample. Thus, the final number of participants totalled 36 individuals, of which 23 were in the EG and 13 in the CG.

As stipulated in the study protocol (Diz et al., 2024b), the G*Power software was used, utilising the ANOVA statistical test of repeated measures with pairwise interaction, in accordance with the literature, with the aim of calculating the number of individuals needed to detect an average effect of 0.55 ($\alpha = .05$, $1 - \beta = 0.95$). Considering that 14 individuals are needed for the effect, to predict dropouts, the authors determined a minimum number of 24 participants.

7.3.3. Instruments

Anthropometry and Body Composition

A stadiometer (Seca 213) was used to measure the height of the participants. The participants were standing barefoot on the platform, leaning against the post of the stadiometer, looking forwards and with their upper limbs alongside their bodies.

A bioimpedance device (Tanita BC-50, Arlington Heights, IL, USA) was used to collect data on body composition, namely weight, body mass index (BMI), muscle mass (kg) and fat mass (kg). For proper data collection, the participants had to stand barefoot in the equipment, with their feet in contact with the electrodes.

HandGrip

To measure upper limbs strength, the handgrip test was carried out using a hand-held dynamometer (CAMRY EH101). Its reliability and validity were confirmed by Oppewal & Hilgenkamp (2020) and Cabeza-Ruiz et al. (2019) and the procedures recommended by the Brockport Fitness Test Manual (Winnick & Short, 2014) were used.

For the test to be carried out correctly, the participants had to place their upper limbs along their body and perform the handgrip. The test was carried out for each of the upper limbs, interspersed, with 3 attempts each and the record was made by calculating the average between the three values, as recommended in the Brockport Fitness Test Manual (Winnick & Short, 2014).

Functional Capacity

For assessment of the participants' physical fitness, the Fullerton functional test battery was applied (Rikli & Jones, 2013).

To assess the strength and endurance of the lower limbs, the 'sit and stand' test was carried out, which is viable and reliable for people with IDD (Hilgenkamp et al., 2012; Wouters et al., 2017). To perform it correctly, participants had to be sitting in the centre of the chair with their back straight, feet shoulder-width apart and fully supported on the floor. When the instructor gave the 'start' signal, the participant had to stand up, perform the maximum extension (vertical position) and then return to the starting position. The number of repetitions performed in 30 seconds was counted and participants were encouraged to complete as many repetitions as possible.

To assess cardiorespiratory capacity, the '6-minute walk' test was used, which is valid and reliable for the population studied (Nasuti et al., 2013). For the test to be carried out correctly, participants had to cover the maximum distance in 6 minutes without running, so at the 'start' signal, participants were instructed to walk as quickly as possible around the distance marked with cones. The distance covered, in metres, was recorded at the end of the test. If necessary, the participants could stop and rest.

Finally, to assess physical mobility, namely speed, agility and dynamic balance, the test 'Timed Up and Go' (TUG) evaluated by Cabeza-Ruiz et al. (2020) was used. Participants had to start the test sitting on a chair, with their hands on their thighs and their feet fully flat on the floor. At the 'start' signal, they had to get up from the chair and walk as quickly as possible (without running) around the cone that was 2.44 metres away, return to the chair and sit down. Before the start of the test, participants should be informed that the test is assessed by calculating the time it takes them to get up from the chair until they sit down again, so when the test is over, the assessor should record the time it takes the participant to complete the test.

7.3.4. Procedures

The initial phase of the study involved direct contact with the interested institutions and potential participants, where the objectives of the research were presented and any doubts regarding the intervention programme were clarified. Subsequently, the individuals who met the defined inclusion and exclusion criteria were identified and approached, with full explanations, both to them and to their families or legal representatives.

Everyone was given the informed consent document, written in clear and accessible language, which described in detail the objectives of the study, the implementation phases, potential benefits and any risks. This document also emphasised that participation was voluntary and could be terminated at any time without any consequences. In addition, the informed consent guaranteed total anonymity and confidentiality of the data collected. Based on the participants' expressions of interest, they were allocated to one of the two groups, EG or CG. Given the interest shown by the participants, the EG had a higher number of participants than the CG. Any questions raised during this process were clarified directly by the principal investigator.

The assessments took place in the morning in an inclusive sports pavilion located in the city of Leiria, properly adapted for exercise by people with disabilities. The space allowed for a functional organisation that respected the privacy of the participants.

All the assessments were carried out by the same research team to ensure uniformity in the procedure. For more details on the study protocol, please refer to the study previously carried out by the same research team (Diz et al., 2024b).

7.4. Intervention

The intervention programme was developed, implemented and monitored by three exercise technicians with proven experience and specific training in working with people with disabilities. Considering the number of participants and their specificities, the involvement of three PE technicians made it possible to ensure adequate monitoring of the participants, namely better supervision, timely feedback and adaptation of the sessions.

During the intervention programme, four team sports were practised: handball, football, basketball and volleyball. Each sport was worked on for four consecutive weeks, corresponding to four sessions, and then practised again after twelve weeks (during which time the other sports were developed).

As for the organisation of the sessions, they were structured systematically, starting with a welcome moment that prioritised the technician-participant relationship, where everyone had the opportunity to express how they felt that day and share events from their week/weekend, followed by a brief overview of what the session would be about. This was followed by the warm-up, in which exercises directly related to the sport to be explored in that day's session were introduced, followed by the fundamental part, centred on the practice of critical components of the sport in focus, and a final game moment, aimed at introducing the formal game of the sport. At the end of the session, in the last 5-10 minutes

or so, the participants had some free time to experiment independently with different sports materials, promoting autonomy, exploration and active involvement.

Each session ended with a moment of reflection, in which participants were invited to express their opinion on the experience. To do this, a simple, visual method was used in which participants were asked to place a bottle cap in one of the three available boxes, each representing a different level of satisfaction (green smile for a positive evaluation, yellow for neutral and red for negative).

The instructions for the exercises were given directly, using demonstrations to make them easier to understand and carry out. Constant encouragement, as well as individualised correction tailored to each participant's performance, were central aspects of the sessions.

The participants' perception of physical effort was assessed after each session, specifically after the “final game”, using the Modified Borg Scale (Borg, 1998), which ranges from 0 (no effort) to 10 (maximum effort) and the Talk Test, a practical and validated tool for estimating exercise intensity in clinical and research contexts (Cowan et al., 2012; Foster et al., 2008; Persinger et al., 2004).

For more details on the intervention programme, we recommend analysing the study protocol previously published by the team (Diz et al., 2024b).

7.5. Statistical Analysis

Regarding data analysis, we conducted a descriptive analysis of the sociodemographic data, using mean values and frequency analysis. Firstly, the normality of the distribution of the variables was assessed using the Shapiro-Wilk test ($n < 50$). Descriptive analyses were then carried out, employing measures of central tendency and dispersion, including the median and interquartile range (IQR).

As the assumptions for using parametric statistics were not met, the non-parametric Mann-Whitney U test was used to compare the EG and CG. For the comparation among the two moments (moment 0 and moment 1) between the EG and CG, non-parametric statistics were applied, specifically the Wilcoxon test. A p-value of $p< 0.05$ was considered to reject the null hypothesis (Ho, 2014).

The data were processed using the statistical software Statistical Package for the Social Sciences (SPSS) - V.27.0, which enabled the necessary statistical calculations for descriptive analysis, visualisation, and discussion.

7.6. Results

Table 11 shows the comparison between the CG and the EG at the pre-intervention moment. As can be seen, in the initial assessment, there are no statistically significant differences between the two groups.

Table 11 -Comparison between GC and EG (pre-intervention)

		Control Group		Experimental Group			
		Median	**IQR**	**Median**	**IQR**	***P***	***Z***
Body Composition	BMI	23.90	10.35	28.30	7.80	0.34	-0.96
	Muscle Mass	43.70	14.45	44.40	14.00	1.00	0.00
	Fat Mass	12.80	17.60	22.20	19.30	0.18	-1.35
Functional physical fitness	Right HandGrip	22.00	15.10	24.00	15.70	0.56	-0.61
	Left HandGrip	19.80	8.05	20.30	14.00	0.85	-0.21
	Sit and Stand Test	13.00	8.00	11.00	5.00	0.23	-1.24
	TUG	6.09	4.37	5.85	3.35	0.92	-0.12
	6 min walk	491.28	166.80	468.43	191.94	0.85	-0.21

Note: BMI- Body Mass Index; TUG- Timed Up and Go test

Table 12 shows the comparison between the GC and the EG at the post-intervention moment. Analysing it, it is possible to verify that in the post-intervention period, as happened in the pre-intervention period, there were no statistically significant differences in the comparison between the two groups.

Table 12 - Comparison between CG and EG (post-intervention)

		Control Group		Experimental Group				
		Median	**IQR**	**Median**	**IQR**	***P***	***Z***	***r***
Body Composition	BMI	26.40	9.15	28.60	8.90	0.20	-1.29	0.046
	Muscle Mass	44.70	14.75	45.30	14.80	0.72	-0.36	0.004
	Fat Mass	15.50	16.40	20.00	21.20	0.15	-1.45	0.058
Functional physical fitness	Right HandGrip	17.80	14.85	21.60	18.90	0.31	-1.02	0.029
	Left HandGrip	18.70	11.50	19.70	16.90	0.95	-0.07	0.000
	Stand and Sit Test	14.00	6.00	13.00	7.00	0.94	-0.08	0.000
	TUG	7.17	3.52	6.21	2.71	0.36	-0.94	0.025
	6 min walk	418.6	151.96	536.98	191.94	0.15	-1.15	0.037

Note: BMI = Body Mass Index; TUG= Timed Up and Go test; r – effect size

The comparison between the pre-intervention (moment 0) and the post-intervention (moment 1) for the EG can be analysed in table 13.

Table 13 - comparison between pre and post intervention moments in the GE

		Moment 0 (pre-intervention)		Moment 1 (post-intervention)				
		Median	IQR	Median	IQR	*P*	*Z*	*r*
Body Composition	BMI	28.30	7.80	28.60	8.90	**0.01***	**-2.63**	**0.301**
	Muscle Mass	44.40	14.00	45.30	14.80	**<0.01***	**-3.15**	**0.431**
	Fat Mass	22.20	19.30	20.00	21.20	0.38	-0.89	0.034
Functional physical fitness	Right HandGrip	24.00	15.70	21.60	18.90	0.81	-0.24	0.003
	Left HandGrip	20.30	14.00	19.70	16.90	0.38	-0.88	0.034
	Stand and Sit Test	11.00	5.00	13.00	7.00	**0.01***	**-2.73**	**0.324**
	TUG	5.85	3.35	6.21	2.71	0.54	-0.61	0.016
	6 min walk	468.43	191.94	536.98	191.94	**<0.01***	**-3.03**	**0.399**

Note: BMI- Body Mass Index; TUG- Timed Up and Go test; r- effect size

When comparing the pre-intervention moment with the post-intervention moment in the EG, it is possible to verify that it presents significant improvements in the variables muscle mass (p<0.01; r=0.301), sit and stand test (p=0.01; r=0.324) and 6 min walk (p<0.01; r=0.399), all with a high effect size. In the BMI variable, a significant difference is also noticeable (p=0.01; r=0.301), with a high effect size, indicating that the variable under study did not undergo a positive change.

Table 14 represents the comparison between the pre-intervention (moment 0) and the post-intervention (moment 1) for the CG.

Table 14 - comparison between pre and post intervention moments in GC

		Moment 0 (pre-intervention)		Moment 1 (post-intervention)				
		Median	IQR	Median	IQR	*P*	*Z*	*r*
Body Composition	BMI	23.90	10.35	26.40	9.15	0.60	-0.53	0.022
	Muscle Mass	43.70	14.45	44.70	14.75	0.28	-1.10	0.093
	Fat Mass	12.80	17.60	15.50	16.40	0.58	-0.56	0.024
Functional physical fitness	Right HandGrip	22.00	15.10	17.80	14.85	**0.02**	**-2.44**	**0.458**
	Left HandGrip	19.80	8.05	18.70	11.50	0.06	-1.85	0.263
	Stand and Sit Test	13.00	8.00	14.00	6.00	0.66	-0.43	0.014
	TUG	6.09	4.37	7.17	3.52	0.31	-1.01	0.078
	6 min walk	491.28	166.80	418.16	151.96	0.88	-0.16	0.002

Note: BMI- Body Mass Index; TUG- Timed Up and Go test; r- effect size

As can be seen in the table mentioned, when comparing the pre-intervention and post-intervention moments for the CG, statistically significant differences were observed in the handgrip test on the right hand (p=0.02; r=0.458), with a high effect size, suggesting a decrease in performance.

Although the differences are not statistically significant, the comparison between the two moments reveals an increase in the median of the sit and stand test, suggesting a

decrease in test performance. Similarly, it is possible to verify an increase in the median for the BMI and fat mass variables of body composition.

Regarding the level of satisfaction, 94.10% of participants expressed high satisfaction with the sessions, 4.42% gave an intermediate evaluation and only 1.48% indicated that they did not enjoy the sessions.

7.7. Discussion

The main aim of this study was to analyse the effect of a 36-week sports-based programme on the body composition and functional fitness of people with IDD.

Considering the results obtained, when comparing the EG and CG at the post-intervention moment, no statistically significant differences were found between the groups. However, when comparing the pre- and post-intervention moments (moment 0 and moment 1) in the EG, it was possible to see that the participants showed significant improvements in the BMI and muscle mass variables relating to body composition and in the sit and stand and 6-minute walk tests relating to functional physical fitness. Regarding the CG, there was a statistically significant difference in the comparison between the two moments (moment 0 and moment 1), specifically in the handgrip test, with the right hand showing a decrease in values.

These results seem to confirm the first two hypotheses initially established, showing that: (i) the EG showed improvements in body composition after 36 weeks of intervention, with regular practice (once a week) of sports and (ii) the EG showed improvements in functional physical fitness after 36 weeks of intervention, with regular practice (once a week) of sports.

With regard to the body composition of the participants in the EG, it is possible to see a significant increase in muscle mass and a significant increase in BMI when comparing the time points, however, although the value is not significant, it is also possible to see a decrease in the participants' fat mass. BMI is calculated using the formula weight divided by height squared, and can increase due to high amounts of muscle mass and/or fat mass. Therefore, an individual with high muscle mass can have a high BMI, even if their body fat is not excessive (Rezende et al., 2010). Thus, the values obtained seem to indicate that the increase in BMI can be justified by the increase in muscle mass, considering that it has

increased, it is normal that the participants' weight has also increased and, consequently, their BMI, despite the slight decrease in fat mass values.

One possible explanation for the lack of a statistically significant difference in the fat mass variable, which is part of body composition, could be related to the fact that variables such as diet were not controlled. Considering that previous studies report that the average calorific ingestion tends to be higher in the IDD population, this is a factor that could be considered relevant (Hoey et al., 2017).

The result achieved for the muscle mass variable seems to be corroborated by the study carried out by Tomé et al. (2024), where the authors found a statistically significant improvement in the muscle mass ($p=0.05$) of the participants. The authors applied a PE intervention programme, using recreational games from team sports, once a week and lasting 60 to 90 minutes, to adults with IDD. Considering the type of intervention and the sample of the study carried out by Tomé et al., (2024), the results they obtained are of particular interest.

The statistically significant difference in the sit and stand test between moment 0 and moment 1 for the EG suggests that the intervention programme contributed to an increase in lower limb strength and endurance. This result can be explained by the exercises carried out during the sessions, namely exercises that involve constant movement, rapid changes of direction and lower limb thrusting, as is the case with various exercises carried out in football, basketball, handball and volleyball. The results obtained are in line with those of the study carried out by Wang et al. (2022), in which the authors implemented a PA intervention programme for 12 weeks, twice a week, using different aerobic games for children with IDD and found significant improvements in the sit and stand test ($p=0.001$). The same occurred in the study carried out by Calders et al. (2011), where the authors found statistically significant differences in the strength and endurance of the lower limbs, using the sit and stand test ($p=0.03$) after a combined intervention programme of strength training and aerobic training, lasting 20 weeks, twice a week, in adults with IDD. In addition, Pedersen et al. (2017), when carrying out an intervention programme based on team sports with an elderly population, found statistically significant differences in the sit and stand test ($p<0.05$), suggesting that it contributed to improving the strength and endurance of the lower limbs.

Our results in the 6-minute walk test also showed a statistically significant difference when comparing the two moments in the EG, suggesting that the intervention programme contributed to improving the participants' cardiorespiratory capacity. These results are in line with those presented by Wang et al. (2022), in which the authors found statistically

significant improvements in the 6-minute walk test, with an increase in the distance covered by children with IDD, after the implementation of a 24-session intervention programme, carried out twice a week, using aerobic games (Wang et al., 2022). Also, in the study carried out by Diz et al. (2021) with adults with IDD, the participants in the EG showed a statistically significant improvement in cardiorespiratory capacity after implementing a 12-week, twice-weekly adapted PA programme. The same occurred in the study by Obrusnikova et al. (2021), where the authors evaluated the effect of a multicomponent resistance training intervention on the strength and functional performance of adults with IDD, and found a statistically significant improvement in the 6-minute walk test ($p<0.05$), suggesting an increase in cardiorespiratory capacity. Also, in the study by Kocić et al. (2017), the authors found that the EG showed a 10% increase in the distance covered in the 6-minute walk test ($p<0.05$), after the implementation of an adapted basketball intervention programme in adolescents with IDD, lasting 8 weeks and 4 times a week.

As mentioned in the previous paragraph, the difference seen in the 6-minute walk test seems to indicate that the intervention programme contributed to an increase in the participants' cardiorespiratory capacity. These results may be related to the fact that the participants tended to lead sedentary lifestyles, and that regular sports practice was included in their routine, since there is a continuous stimulus for developing this capacity. In addition, team sports, such as those practised during the sessions, involve constant movement, changes of direction and moments of running, which promote cardiovascular and respiratory adaptations (Yue & Hong, 2023). It should also be noted that, as we have already seen, there was an improvement in the strength and endurance of the lower limbs, which may have contributed to the participants being able to cover a greater number of metres more efficiently and with less fatigue in the lower limbs.

Regarding the CG, it was possible to see a statistically significant difference when comparing the two moments in the handgrip test for the right hand. Since the CG participants maintained their usual daily activities, the reason for this difference is not obvious. However, we can say that the intervention programme seems to have contributed to maintaining strength in the upper limbs of the EG, as there were no significant changes in the handgrip tests, unlike the CG.

One possible explanation for the lack of significant differences in the other physical fitness variables in the EG may be related to the weekly frequency of the sessions. Although one session a week is beneficial and has brought benefits in several of the variables under study, it may not have been enough to promote improvements in upper limb strength and agility, balance and speed. Although some of the sports worked on during the sessions

included the use of the upper limbs (e.g. throwing in handball or basketball), the intensity, frequency and specificity of the stimulus may not have been sufficient to bring about measurable gains in handgrip strength. Increasing the weekly frequency could lead to improvements in these variables.

Despite the obvious difficulties in executing exercises orientated towards gripping balls, dribbling and throwing, it is worth highlighting the improvements seen over the course of the sessions, where a more efficient grip was visible, as well as more precise and controlled throws. Despite the limitations, these improvements were also seen in exercises where ball handling with the feet was prioritised, as in the case of football. Even though they are not quantifiable improvements, it is pertinent to mention them, especially as they are related to exercises that require the simultaneous performance of two or more tasks and this is a difficulty experienced by this population (Jankowicz-Szymanska et al., 2012; Martin et al., 2010).

As well as analysing the effect of sports on the body composition and physical fitness of adults with IDD, the intervention programme had the additional objectives of mitigating barriers to the practice of PA, PE and sports, as well as valuing the preferences and needs of the participants, including their opinion of the sessions. In this context, the evaluation of participant satisfaction revealed extremely positive feedback on the sessions (94.10%), suggesting that the intervention contributed to the motivation and ongoing involvement of the participants. This can be supported by the absence of dropouts attributed to the programme itself, contrary to evidence presented by other studies, which report the low participation of people with IDD in PA and PE intervention programmes (Gjestvang et al., 2020). Monitoring participants' satisfaction allows PE technicians to understand which exercises, activities, games and modalities participants enjoy the most, analyse the sessions based on this feedback and make the necessary adjustments. These adjustments should preserve the fundamental components to be developed but seek to align with the interests and preferences of the participants, promoting their inclusion, active listening and motivation.

The high level of adherence to the programme and the results achieved reinforce the importance of integrating this type of intervention into institutional and community contexts. It is therefore essential that exercise instructors, institutions and local authorities actively contribute to its implementation and, just as importantly, to its continuity over time.

In short, the results obtained suggest that the intervention programme, based on the practice of sports, contributed to an improvement in the variables of muscle mass, strength and endurance of the lower limbs and cardiorespiratory capacity.

7.8. Limitations and Future Recommendations

As with any study of a similar nature, this one also has some limitations that must be considered.

These include the periodicity of the sessions, mentioned above. Despite the benefits of holding a weekly session and the long duration of the programme, for logistical reasons, namely space management and coordination with the institutions' programme of activities, it was not possible to hold a greater number of weekly sessions. Therefore, as recommendations for future studies, we suggest at least holding bi-weekly sessions.

Another relevant limitation concerns the lack of control of external variables. The fact that variables such as diet, medication and the amount of PA performed in an institutional context were not controlled are limitations to consider. It is therefore suggested that future research include control of these variables. In addition, the scarcity of studies exploring the impact of sports-based programmes on the body composition and functional physical fitness of the population is notorious, so comparing the results obtained is limited. It is therefore suggested that more studies be carried out, particularly longitudinal and follow-up studies that contribute to research in this area. Finally, it is recommended that future research consider more representative samples and include different degrees of severity of IDD.

7.9. Conclusion

The 36-week weekly intervention showed statistically significant improvements in body composition, particularly muscle mass, as well as lower limb strength and endurance, cardiorespiratory capacity and functional physical fitness. These results are particularly relevant considering the motor and functional difficulties often associated with this population, thus reinforcing the role of sports as an asset for promoting health, physical fitness and QoL.

The evaluation of the participants' satisfaction indicated that the vast majority of the sessions were enjoyed, a factor that may have contributed to their increased motivation and, consequently, to the low drop-out rate. It should be noted that none of the participants left the intervention for reasons related to the programme.

The results achieved and adherence to the programme support the importance of including this type of intervention in institutional and community contexts. In this sense, it is important that PE technicians, institutions and local authorities reflect on the importance of these programmes, recognise their value and contribute to their development.

In short, this study aims to contribute to the advancement of knowledge in the field of sports science by demonstrating that structured sports programmes, implemented on a regular basis, with a focus on the individual, can bring benefits in terms of body composition and functional physical fitness for people with IDD, paving the way for future research and the implementation of more inclusive and effective policies.

7.10. Ethics statement

This study was approved by the Ethics Committee of the University of Beira Interior, receiving the code No. CE-UBI-Pj-2023-061.

All eligible individuals, as well as their caregivers or legal guardians, were informed about the purposes and procedures of the research through a consent form written in clear and accessible language.

The confidentiality and anonymity of the data were fully safeguarded

7.11. References

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Chapter 8 – Conclusions, Limitations and Future Research Proposals

The main objective of this thesis was to understand and analyse the impact of regular PA, PE and, in particular, sports on functional physical fitness, body composition, QoL and well-being in people with IDD. Structured in six complementary studies, including a systematic review, a cross-sectional study, a narrative review, an intervention protocol, and two experimental studies, it sought not only to contribute scientific knowledge about the influence of PA, PE, and sports on this population, but also to contribute practical implications and evidence for future studies.

In order to understand what has been established regarding the influence of PA, PE and sport on QoL and well-being in people with IDD, a systematic review was conducted (Diz et al., 2024a). Despite the diversity of the objectives and methodologies of the included studies, the analysis seems to indicate that regular PA, PE, and sports contribute to improved QoL (Tomaszewski et al., 2022; Mercado et al., 2021; Özkan and Kale, 2021; Snapp et al., 2020; Carbó-Carreté et al., 2016; Crawford et al., 2015; Carmeli et al., 2008) and well-being (Moltó and Bruna, 2017; Barnet-Lopez et al., 2016; Bowers et al., 2016; Carmeli et al., 2008; Carmeli et al., 2005) of this population. Despite the growing interest in the topic, the systematic review identified a significant gap in the literature regarding the prescription and evaluation of programmes of this nature for people with IDD, especially with regard to programmes based on the practice of sports. Most of the studies included address PA and PE, have unsatisfactory methodological quality, and small samples. Thus, there is a clear need for further research specifically exploring the impact of sports programmes on this population, which reinforces the relevance and necessity of the subsequent studies in this thesis.

The analysis of the influence of PA, PE and sports practice becomes even more relevant when considering the different comorbidities frequently observed in this population, largely associated with a sedentary lifestyle (Bergström et al., 2013; Esposito et al., 2012; McKeon et al., 2013; O'Leary et al., 2018). People with IDD tend to have higher levels of overweight/obesity, type II diabetes, hypertension and cardiovascular disease (Haveman et al., 2010; Krahn & Fox, 2014; O'Leary et al., 2018). Although multiple factors contribute to these conditions (Emerson et al., 2014), physical inactivity stands out as one

of the main risk factors for the health of this population (Bergström et al., 2013; Esposito et al., 2012; McKeon et al., 2013; O'Leary et al., 2018). As a consequence of physical inactivity, people with IDD also tend to have low levels of physical fitness, including reduced levels of strength, cardiorespiratory capacity, balance, and flexibility (Chow et al., 2018; Wouters et al., 2017). Lower functional capacity indices are associated with lower QoL (Williams et al., 2021).

Thus, with the aim of analysing the associations between functional physical fitness and QoL, a cross-sectional study was conducted (Diz et al., 2024b), which aims to complement the information collected with the systematic review and support the work that follows. The results of the study seem to reinforce the positive association between certain functional capacities and well-being, namely physical well-being, reported in the literature as a determining indicator of QoL (e.g., Saviani-Zeoti & Petean, 2008). Thus, the results suggest that, for the sample under study, lower limb strength and cardiorespiratory capacity appear to be associated with higher levels of physical well-being, reinforcing the importance of promoting PA, PE and sports programmes to improve QoL and well-being in this population. These data support the potential benefits that structured PA, PE and sports programmes can have on QoL and well-being in people with IDD.

The narrative review article plays an important role in the structure and coherence of this thesis. By clarifying the ethical issues inherent in research involving people, namely the use of CG, informed consent and the importance of understanding on the part of participants, this review reinforces the need to ensure scientific rigour without neglecting the human aspect, providing relevant ethical guidelines, particularly in the use of people with IDD in scientific research. Thus, the narrative review emerges as a relevant complement that ethically supports the methodological decisions adopted in subsequent experimental studies, ensuring that they are carried out in accordance with the assumptions of scientific ethics that apply to them, as well as with the expected integrity and equality.

Considering the barriers and facilitators to the practice of PA by people with IDD, namely the short duration of intervention programmes, the reduced offer of practice, low adherence to sessions, lack of community support, motivational factors and the need for specialised technicians (Jacinto et al., 2021; McGarty and Melville; 2018; Bossink et al., 2017), it is imperative to implement interventions that meet the interests and needs of this population. In this sense, the study protocol developed (Diz et al., 2024c) aimed to structure, in detail, the intervention to be carried out (which encompasses the two experimental studies), seeking to promote physical fitness, QoL, and well-being, while

ensuring that there is space to adapt the programme to the needs, preferences, and opinions of the participants (Diz et al., 2024c).

The results obtained in the first experimental study (Diz et al., 2025) highlight the positive impact that the intervention programme, based on sports activities, with weekly sessions of 60 minutes each, over 36 weeks, adjusted to the needs and interests of individuals, seems to have on QoL and well-being in people with IDD. In the present study, statistically significant differences were observed for the EG in the domains of self-determination, social inclusion, physical and emotional well-being of QoL, as well as in life satisfaction, positive affect and negative affect of well-being.

Equally promising results were obtained in the second experimental study, which aimed to assess the influence of the same intervention programme on the body composition and functional physical fitness of people with IDD in an institutional setting. Thus, statistically significant differences were found for the EG in BMI and muscle mass, as well as in the sit-to-stand test, associated with lower limb strength and endurance and in the 6-minute walk test, which assesses cardiorespiratory capacity.

In addition, through the satisfaction assessment, participants demonstrated a high level of satisfaction with the intervention programme, which seems to confirm that the sessions respected their interests, preferences and needs. The value placed on participants' opinions, the way the sessions were conducted and the environment in which they took place seem to have contributed to this positive perception. These aspects may also have contributed to the high adherence and retention of people with IDD in the intervention programme, contrary to data from other studies, which report low participation of individuals with IDD in PA and PE intervention programmes (Gjestvang et al., 2020).

The studies conducted within the scope of this thesis highlight the importance of regularly implemented, person-centred intervention programmes as an effective tool for improving not only QoL and well-being, but also the functional physical fitness of people with IDD. In this sense, interventions aimed at practising sports seem to meet the preferences and interests of this population, keeping them engaged and committed, contributing to the reduction of sedentary lifestyles, which are commonly associated with people with IDD and negatively influence their health.

However, the results of this thesis should be considered with some caution, as there are limitations that are important to identify. Thus, the main limitations of this thesis are related to the impossibility of randomising participants by group, due to the restrictions of the institutional context in which the sample was recruited, added to the lack of control over

caloric intake and the amount of PA practised outside the intervention programme, as well as the reduced weekly frequency of sessions, factors that may have influenced the results obtained in some way.

As future recommendations, we suggest increasing the weekly frequency of sessions (to at least twice a week), as well as a more detailed analysis of the role of variables such as gender, age, IQ, functionality, or type of previous experience in sport, in order to concentrate the transfer of results and facilitate it to other contexts. Monitoring diet, medication, and PA outside the intervention programme are issues that we also suggest be considered in future studies. In addition to the above, there is a need for longitudinal and follow-up studies that contribute to research, with representative samples that include different degrees of IDD severity.

In order for this population to change their sedentary behaviours, it is necessary to raise awareness and educate not only people with IDD, but also their guardians, professionals, institutions/organisations and local authorities that support this population, empowering all those involved with tools that contribute to the promotion of a healthier life, more active and full social participation. The intervention programme presented can be replicated, as it is easy to understand and implement, using materials that are easily accessible. Considering the significant improvements in functional physical fitness, QoL and well-being of this population, the results seem to indicate that the intervention programme can be an effective strategy.

The contributions of this research are relevant at both a scientific and practical level. From a scientific point of view, it fills a gap in the literature, especially with regard to sports practice in people with IDD. From a practical point of view, it offers a feasible and replicable intervention model that can be implemented by institutions, PE technicians, local authorities and health professionals, promoting the health, well-being, QoL and social inclusion of this population.

Promoting physical fitness, QoL and well-being among people with IDD should be a collective priority, and sport, when designed to be inclusive and adapted to the interests, needs, preferences and goals of participants, proves to be a powerful ally in this endeavour. It is hoped that the research carried out in this thesis will contribute to increasing interest in this area, producing more and more knowledge that will raise awareness among policy makers (local and national), professionals and communities, encouraging the creation of sustainable sports programmes that are accessible to all.

8.1. References

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Appendices

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Parecer relativo ao processo n.º CE-UBI-Pj-2023-061-ID1946

Na sua reunião de 19 de dezembro de 2023, a Comissão de Ética apreciou a documentação científica submetida referente ao pedido de parecer do projeto **"O papel do desporto na aptidão física, qualidade de vida e bem-estar de pessoas com dificuldade intelectual e desenvolvimental",** da proponente **Susana Cristina Oliveira Diz,** a que atribuiu o código n.º CE-UBI-Pj-2023-061.

Na sua análise não identificou matéria que ofenda os princípios éticos e morais, sendo de parecer que o estudo em causa pode ser **aprovado**.

Covilhã e UBI

A Presidente da Comissão de Ética

Assinado por : **AMÉLIA MARIA MONTEIRO FERNANDES NUNES**
Num. de Identificação: BI102417849
Data: 2024.01.14 22:00:08+00'00'

CARTÃO DE CIDADÃO

(Professora Doutora Amélia Maria Monteiro Fernandes Nunes)

(Professora Auxiliar)