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Fashion-related Approaches to the Psychosocial and Clinical Management of Adolescents with Overweight & Obesity

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ABSTRACT

Background | The prevalence of adolescents with overweight and obesity (AOO) is increasing worldwide while resulting in deleterious biopsychosocial effects. The importance of social and environmental change is recognized to reduce obesity, plus the need to identify new ways for healthcare providers to be part of broader efforts. A possible mediator to achieving such goals is *Fashion*. Evidence suggests that clothing systematically influences cognitive/emotional processes and well-being. Taking into account the challenges faced by AOO, they may benefit particularly from interventions related to fashion.

Objectives | Assess whether fashion-related mediators relate to AOO and the relevance of possible fashion-related approaches in AOO.

Methods | Search: In December 2021, 3 databases were assessed. Researchers were contacted to obtain unpublished data. Selection criteria: we included interventional and observational studies; excluding editorials, reviews, abstracts, position papers, and letters. Data Collection and analysis: we followed recommendations from *Cochrane*. The risk of bias for experimental studies was accessed with *Revised Cochrane risk-of-bias for randomized trials* while for observational studies, the *Quality Assessment Tool for Quantitative Studies* was applied. Analysis was reported using the mean difference and pooled effect sizes.

Main Results | We included 23 studies of 10,008 participants. Of these, 59% were girls, 41% were boys and 1% did not report gender. Seven studies were experimental and 16 observational. Although included studies show that fashion-related mediators – *like body image, appearance-focused media, footwear design, clothing size, fitting into different clothes, clothing shopping experience,* and *hairstyle* – influence outcomes in AOO, these results should be taken with caution as the majority of studies show some concerns regarding the risk of bias.

Authors' Conclusion | Fashion-related mediators may play an important role in the clinical management of AOO. More studies should be performed to further evaluate these mediators and the resulting clinical outcomes.

Keywords | Fashion; Biopsychosocial; Fashion-related Mediators; Adolescent obesity; Quality of Life.

RESUMO

Introdução | A prevalência de adolescentes com excesso de peso e obesidade (AOO) continua a aumentar, resultando em efeitos psicossociais deletérios. Atualmente é reconhecida a importância dos fatores sociais e comportamentais para reduzir a obesidade, além da necessidade de identificar novas formas de intervenção por parte dos profissionais de saúde. Um possível mediador para atingir tais objetivos é a Moda. A evidência mostra a influência sistemática do vestuário nos processos cognitivos/emocionais e no bem-estar. Tendo em conta os desafios enfrentados pelos AOO, estes poderão beneficiar de intervenções relacionadas com moda.

Objetivos | Avaliar a relação de mediadores associados à moda com AOO e a relevância destas abordagens junto de AOO.

Métodos | Pesquisa: Em dezembro de 2021, 3 bases de dados foram pesquisadas. Foram contactados investigadores para obter dados não publicados. Critérios de seleção: incluímos estudos de intervenção e observacionais; excluímos editoriais, revisões, resumos, artigos de posicionamento e cartas. Colheita e análise de dados: recomendações da *Cochrane* foram seguidas. O risco de viés para estudos experimentais foi avaliado pelo *Revised Cochrane risk-of-bias for randomized trial*, enquanto para estudos observacionais foi aplicado o *Quality Assessment Tool for Quantitative Studies*. Medidas de efeito: diferença de médias e *effect sizes*.

Resultados Principais | Incluímos 23 estudos e 10.008 participantes: 59% meninas; 41% meninos; 1% não reportou. Sete estudos foram experimentais e 16 observacionais. Embora os estudos incluídos mostrem que os mediadores relacionados com a moda – imagem corporal, conteúdo focado na aparência, calçado, tamanho da roupa, vestir diferentes roupas, experiência de compra de roupas e estilos de cabelo – influenciam os AOO, estes resultados devem ser interpretados com moderação, pois a maioria dos estudos apresenta um risco de viés intermédio.

Conclusão | Os mediadores relacionados com a moda podem ter um papel importante na gestão clínica de AOO. Mais estudos são necessários para melhor avaliar estes mediadores e os resultados clínicos obtidos.

Palavras-chave | Moda; Biopsicossocial; Mediadores relacionados à moda; Adolescentes com obesidade; Qualidade de Vida.

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ABBREVIATIONS

AAA – African American adolescent

AAP – The American Academy of Pediatrics

AOO - Adolescents with Overweight and Obesity

BMI – Body mass index

CDI – Children's Depression Inventory

CESD-R – Center of Epidemiologic Studies Depression Scale-Revised

CohS – Observational Cohort Studies

CSz – Clothing Size

CS – Cross-sectional studies

CZ – Czech Republic

ED – Eating Disorders

EPHPP – EIective Public Health Practice Project

FRS – Figure Rating Scale Instruments

HRQoL – Health-Related Quality of Life

KIDSCREEN-52 – Health Questionnaire for Children and Young People, Child and Adolescent Version

MI – Motivational Interviewing

MM – Mixed Methods Research

NCDs – Noncommunicable Diseases

PANAS – Positive and Negative Affect Scale

PedsQL – Pediatric Quality of Life Inventory

PRISMA – Preferred Reporting Items for Systematic Reviews and Meta-Analysis

QS – Qualitative Studies

RCFT – Randomized Controlled Field Trials

RCT – Randomized Controlled Clinical Trials

RoB – Revised Cochrane risk-of-bias tool for randomized trials

SCS – Self-Controlled Study

SMI – Social Marketing Intervention

SRSC – Size-Related Self-Concept

TAU - Treatment as Usual

TBS – Trait Body Satisfaction

UK – United Kingdom

USA – United States of America

VAS - Visual Analogue Scale

WC – Waist Circumference

WHO – World Health Organization

BACKGROUND

Description of the condition

Overweight and obesity are defined as abnormal or excessive fat accumulation – a body mass index (BMI) of 25 is considered overweight, and over 30 is obese (World Health Organization, 2021b). In the paediatric population, age needs to be considered, and so, overweight and obesity are defined in percentile: overweight can be defined as BMI or waist circumference (WC) ≥ 85th percentile to 97th percentile, BMI > one standard deviation above the average; obesity: BMI or WC > 97th, two standard deviations above the average (Reilly, Kelly, & Wilson, 2010; Rolland-Cachera, 2011; World Health Organization, 2020).

The prevalence of overweight and obesity is increasing worldwide, and in 2019 about 51.3% of Europeans were overweight and from these 16% were obese (Eurostat, 2021). A special sub-group is adolescents with overweight and obesity (AOO) as a growing body of evidence shows links between this condition and the propensity to develop noncommunicable diseases (NCDs) – also known as chronic diseases – both in childhood and later in life, increased the risk of premature illness and death, raising public-health concerns (Ebbiling, C. B., Pawluk, D., Ludwig, 2012; Tatlow-Golden et al., 2021). Also, obesity and NCDs are implicated in negative outcomes for communicable diseases such as COVID-19 (Tatlow-Golden et al., 2021). The prevalence of AOO around the world has risen, however, analyses of data show they have stabilized or have even decreased in some European countries (Southern Europe) and remained static or slightly increased in Northern European and Eastern European countries with nonrelevant differences between boys and girls (Ahrens & Branca, 2021). Besides that, AOO prevalence in Portugal was among the highest in Europe in 2014 (Fonseca, Palmeira, Martins, Falcato, & Quaresma, 2014) and recent data extracted (Eurostat, 2021) for the age range 15 to 24 in Portugal, show an increase in BMI = 25-29 kg/m^2 from 2014 to 2019, mainly because of males; and an increase in the category of BMI ≥ 30 kg/m^2 from 2014 to 2019, seen in both girl and boy (Table S1). Therefore, more effective actions and investments are needed to reach the targets proposed by the WHO Global Action Plan for the Prevention and Control of Noncommunicable Diseases, especially the global action plan

on physical activity 2018-2030 as well as to implement the recommendations of the Commission on Ending Childhood Obesity 2016, which includes prevention, identification and reducing the risk of mobility and mortality, lessen the negative psychosocial effects of obesity and reduce the risk of the next generation developing obesity (WHA, 2016). In fact, in instruments to access the quality of life in the paediatric population as KIDSCREEN-52, the scores were lowest in the subscales of *physical well-being*, *self-perception*, *social acceptance* and *bullying* (Ottova, Erhart, Rajmil, Dettenborn-Betz, & Ravens-Sieberer, 2012). Also, recommendations (Barlow, 2007) about managing AOO treatments state the importance of patient-centered counselling techniques and recognize the importance of social and environmental change to reduce obesity and identify new ways for healthcare providers and healthcare systems to be identified as part of broader efforts. As a result, and given the recent developments in the area of Fashion Theory research, here we explore how fashion can be a mediator of better outcomes in the clinical management of AOO and how it can be used as an approach in this context. If in the simplest meaning, clothes are carried on the body and are in some way attached to it, there is a much more complex relation between clothing and the self which is gaining growing attention nowadays (Choufan, 2021).

The interesting aspect is that William James – a physician, psychologist and who established Harvard's psychology department – published, in 1890, this important relationship (between psychology and clothing) through the concept of "clothed self" in the *Principles of Psychology*. In his chapter on "The Consciousness of the Self", James says that the self is the total of what he can call his while being constituted of "fluctuating material" as his clothes (W. James, 1890). Besides that, even before 1890, Hermann Lotze – physician and philosopher – wrote the *Philosophy of Clothing*, which stated the art of dressing as being part of the self and expressed that clothing contributes to the consciousness of our personal existence (C. A. Watson, 2004).

It is fascinating to observe how concepts evolve. In the present time, we have research being conducted on the aspects of dressing the self and the senses and the development of new concepts such as enclothed cognition, self-objectification through dressing and its influence. Plus the influence of colour in psychology and physiology (e.g., the influence of colour on emotions and physical exercise – both relevant in the context of

this project), not to mention the influence of other characteristics of clothing as texture, materials (including dyes, fibres and residues – import not only in immunoallergology, but also, in psychology), health monitoring technology being merged to clothing/accessories (smartwatches and smart clothing – sensors for medical surveillance) and applying other health-related functionalities into clothing as ultraviolet light protection, thermoregulation, antibacterial and others (Adam & Galinsky, 2012; CITEV, 2022; Dreborg, Tsai, & Kim, 2020; Eicher, 2020; Elliot, 2015; Elliot & Aarts, 2011; Jalil, Yunus, & Said, 2012; Pilarczyk, Kuniecki, Wołoszyn, & Sterna, 2020; Schlaffke et al., 2015; Slepian, Ferber, Gold, & Rutchick, 2015; Weigand, Edelkraut, Conrad, Grimm, & Bajbouj, 2021; Wilms & Oberfeld, 2018; Zielinska, Mayhorn, & Wogalter, 2017). Therefore, it is not a surprise that the definition of fashion has evolved. Indeed, Fashion is defined by Susan B. Kaiser (Kaiser, 2019) as:

> "A form of self-expression and autonomy at a particular period and place and in a specific context, of clothing, footwear, lifestyle, accessories, makeup, hairstyle, and body posture."

Clothes act as a "demonstration of identity" and are part of a constructed identity and construction of identity (Choufan, 2021). This is especially important in adolescents as they are building and developing their personality and facets while living a dramatic time of physical, social, and psychological change (Brandes, Kushner, Herzhoff, & Tackett, 2020). This is especially evident in AOO, as some studies have shown a progressive deterioration of perceived health-related quality of life (HRQoL) in these adolescents (Fonseca et al., 2014; Freira et al., 2019; Steinbeck, Lister, Gow, & Baur, 2018).

Description of the intervention

Clinical guidelines for the prevention and treatment of adolescent obesity recommend a multicomponent approach that combines (Martin et al., 2018):

1. Reduce energy intake;
2. Increased physical activity;
3. Decreased sedentary behaviour;
4. Cognitive-behavioural techniques;

Given the development of recent knowledge in fashion and fashion-related interventions in medical areas (e.g., oncology) (Richard, Harbeck, Wuerstlein, & Wilhelm, 2019; Taggart, Ozolins, Hardie, & Nyhof-Young, 2009), plus the need to improve quality of life of AOO to achieve better treatment outcomes, the screening for fashion-related mediators and possible fashion-related approaches might help to achieve clinically meaningful improvements in HRQoL and treatment outcomes in adolescents with overweight and obesity.

OBJECTIVES

To assess whether there is evidence of fashion-related mediators influencing AOO and associated fashion-related interventions that possibly contribute to the clinical management of AOO and their multicomponent treatment outcomes.

METHOD

We conducted our review based on the Preferred Reporting Items for Systematic Reviews and Meta-Analysis – The PRISMA 2020 statement (Page et al., 2021) and registered our review online under the international prospective register of systematic reviews. The protocol can be accessed at www.crd.york.ac.uk/prospero through the registration number CRD42021292701.

Criteria for considering studies for this review

Criteria for considering studies for this review

Types of studies

Cross-sectional surveys to learn about the possible effects of an approach or treatment were included. It was also considered studies employing qualitative, mixed methods research, cohort studies, case-control studies, nested case-control studies, randomized controlled clinical trials (RCT) and randomized controlled field trials (RCFT) to evaluate interventions. Therefore, this approach separates studies into two broad categories: (1) experimental studies, and (2) observational studies, which are taken as supporting studies and usually have a high risk of bias. This was done because, as expected, this is a new area of intervention, mainly still exploratory, and we wanted to summarize the

best available evidence. This approach has been done previously at least 3 other Cochrane Reviews, which consider evidence from various sources of the study design (Gruen, Weeramanthri, Knight, & Bailie, 2003; Lhachimi et al., 2020; Turley, Saith, Bhan, Rehfuess, & Carter, 2013). Also, we intended to include studies regardless of their publication status.

Types of participants

Studies of AOO with a mean study age of 10 to 19 at the commencement of the intervention were included.

Diagnostic criteria

Any method to measure overweight or obesity was acceptable. The definition of adolescence was based on the definition stated by the World Health Organization (WHO) (World Health Organization, 2021a), as well as to define overweight and obesity (World Health Organization, 2021b).

Types of interventions

Any form of fashion-related interventions to better manage the psychosocial and rehabilitation process and/or positively contribute to better outcomes of AOO. As so, in this study fashion-related concepts were understood as mediators for AOO.

Comparator

When possible, the inactive comparator was no treatment and/or treatment as usual (TAU), also called standard care or usual care. Also, when possible, the active comparators were a fashion-related intervention versus another different fashion-related intervention (including colour vs another colour); fashion-related interventions applied to other medical conditions.

Types of outcome measures

Primary and secondary outcomes were defined following the recommendations of Barlow (Barlow, 2007), and also, taking into account the results of different studies (Ajibewa et al., 2021; Castonguay, Gilchrist, Mack, & Sabiston, 2013; Donini et al., 2020; Freira et al., 2019; Kohn et al., 2006; Oude Luttikhuis et al., 2019; Silva et al., 2019; Tiggemann & Andrew, 2012; Whitlock, O'Connor, Williams, Beil, & Lutz, 2008).

Primary outcomes

1. Health-related quality of life (HRQoL), including instruments of assessment;
2. Behaviour Change/Overcome challenges/treatment compliance;
3. Changing nutrition choices/eating-related behaviours;
4. Symptoms of depression;
5. Patient-reported adverse events.

Secondary outcomes

1. Body mass, measured as change in BMI or other anthropometric measures than a change in BMI to assess body composition;
2. Physical Activity, Physical Exercise and Physical Performance, including: enjoyment and willingness to perform physical activity or exercise; activity choices; improvement in sports performance; changes in metabolic rate;
3. Emotional functioning, including motivation, stress resilience, self-esteem, body image, empowerment and fitting into different clothes; size-related self-concept (SRSC); arousal; valence ratings;
4. Social functioning, including stigma;
5. School functioning;
6. Skin conductance responses;
7. Heart rate;
8. Electrophysiological responses;
9. Markers of Inflammation.

Search methods for identification of studies

Searches

Literature searches were conducted from the earliest date available through December 2021 in the following online bibliographical database: PubMed, Web of Science and APA PsycNet. Terms related to fashion were entered in conjunction with terms related to adolescents with overweight and obesity using Boolean operators (e.g., “obese adolescents” AND “emotion” AND “clothing”). Terms for fashion were selected based on the definition proposed by Susan B. Kaiser (Kaiser, 2019): clothing, footwear, accessories, makeup and hairstyle. Other relevant fashion-related terms were also

included (Bennett, Wagner, Obleada, & Latner, 2020; Elliot & Aarts, 2011; Valdez & Mehrabian, 1994; Wilms & Oberfeld, 2018) colour and media exposure. Terms for adolescents with overweight and obesity were selected based on the PedsQL Measurement Model (Varni, 2021): exercise, emotion, social and school. Other relevant terms related to the last subject were used (Fonseca et al., 2014; Hendriks, Schotanus-Dijkstra, Graafsma, Bohlmeijer, & de Jong, 2020): body dissatisfaction, resilience, neuroaesthetics, self-efficacy and obese adolescents.

Restrictions on the search

Studies written in Mandarin were excluded. Furthermore, editorials, reviews, abstracts, position papers and letters were excluded. Also, studies with a sample size of less than 10 were excluded. We did not exclude studies according to patient gender.

Data collection and analysis

Selection of studies

A web-based software platform, Rayyan.ai (Ouzzani, Hammady, Fedorowicz, & Elmagarmid, 2016), was used to view, screen and select studies, including the elimination of duplicates. The titles and abstracts of all records were screened against the eligibility criteria. Potentially relevant studies underwent full-text screening to determine their inclusion statuses. The study selection process was conducted by the student and any doubts were solved through consensus with the supervisor. An adapted "Preferred Reporting Items for Systematic Reviews and Meta-Analysis" (PRISMA) flow chart showing the process of study selection was generated – Figure 1.

Data extraction and management

The following study characteristics were extracted from each of the original studies: authors and year of publication, design, sample size, population, intervention, outcome(s) and the main findings. Data were entered into a table and the information was compared to check for accuracy. Disagreements were solved by a discussion with the supervisor.

Risk of bias assessment

The risk of bias was evaluated for each included study and was assessed using different tools, depending on the nature of the study design. Based on the recommendation by the PRISMA statement (Page et al., 2021) and Cochrane (Cochrane Handbook for Systematic Reviews of Interventions, Version 6.2, 2021), the 'Risk of bias' for experimental studies was accessed with the Revised Cochrane risk-of-bias tool for randomized trials (RoB 2), current version: 2019 (Higgins, Savović, Page, & Sterne, 2019). This tool examines the following domains: randomisation process, deviations from the intended interventions, missing outcomes, measurement of the outcome, selection of reported results and other sources of bias. Each study was judged as 'low risk', 'high risk' or 'unclear risk'. We computed a graphic representation of potential bias using the Excel tool to implement Rob 2.

The risk of bias of 'supporting studies' was assessed with the Quality Assessment Tool for Quantitative Studies, developed by the Effective Public Health Practice Project (Effective Public Health Practice Project, 2010). This tool examines the following domains: selection bias, study design, confounders, blinding, data collection methods, withdrawals and dropouts, intervention integrity, analysis, and a global rating. As a result, each study is judged as having strong, moderate, or weak evidence. To compute all study designs in the same figure, the global rating was inserted in the Excel tool of RoB 2. So, a study classified as 'strong' in the EPHPP corresponded to the 'low risk' at RoB 2; 'moderate' (EPHPP) = 'unclear risk' (RoB 2); 'weak' (EPHPP) = 'high risk' (RoB 2).

Analysis of subgroups or subsets

When possible, we analysed the following subgroups: gender.

Strategy for data synthesis

Characteristics of the included studies and interventions were summarized narratively. Also, a synthesis of the included studies was entered into Microsoft Excel® and reported in a table – Table 1. Data of the same outcomes were pooled using meta-analyses under the random-effect model. The Review Manager software 5.4.1® was used to calculate the mean differences and standardized mean differences (SMD) – depending if included studies used same or different scales to report outcomes – and 95% confidence intervals

(CI)(Higgins JPT at al., 2022). Heterogeneity of results were also assessed using Review Manager software 5.4.1®.

RESULTS

Description of studies

Results of the search

The electronic search for this review yielded 396 records. Having excluded 31 duplicate records, the remaining 365 were screened based on title and abstract. It was included 23 studies in total in this review. A flow chart of the search results is shown in Figure 1.

Characteristics of included studies

Table 1 provides information on each study's methodology, sample size, population, intervention, outcomes and relevant findings in the context of fashion-related determinants in adolescents with overweight and obesity (e.g., the influence of hairstyle in sports, body dissatisfaction, dysfunctional appearance beliefs).

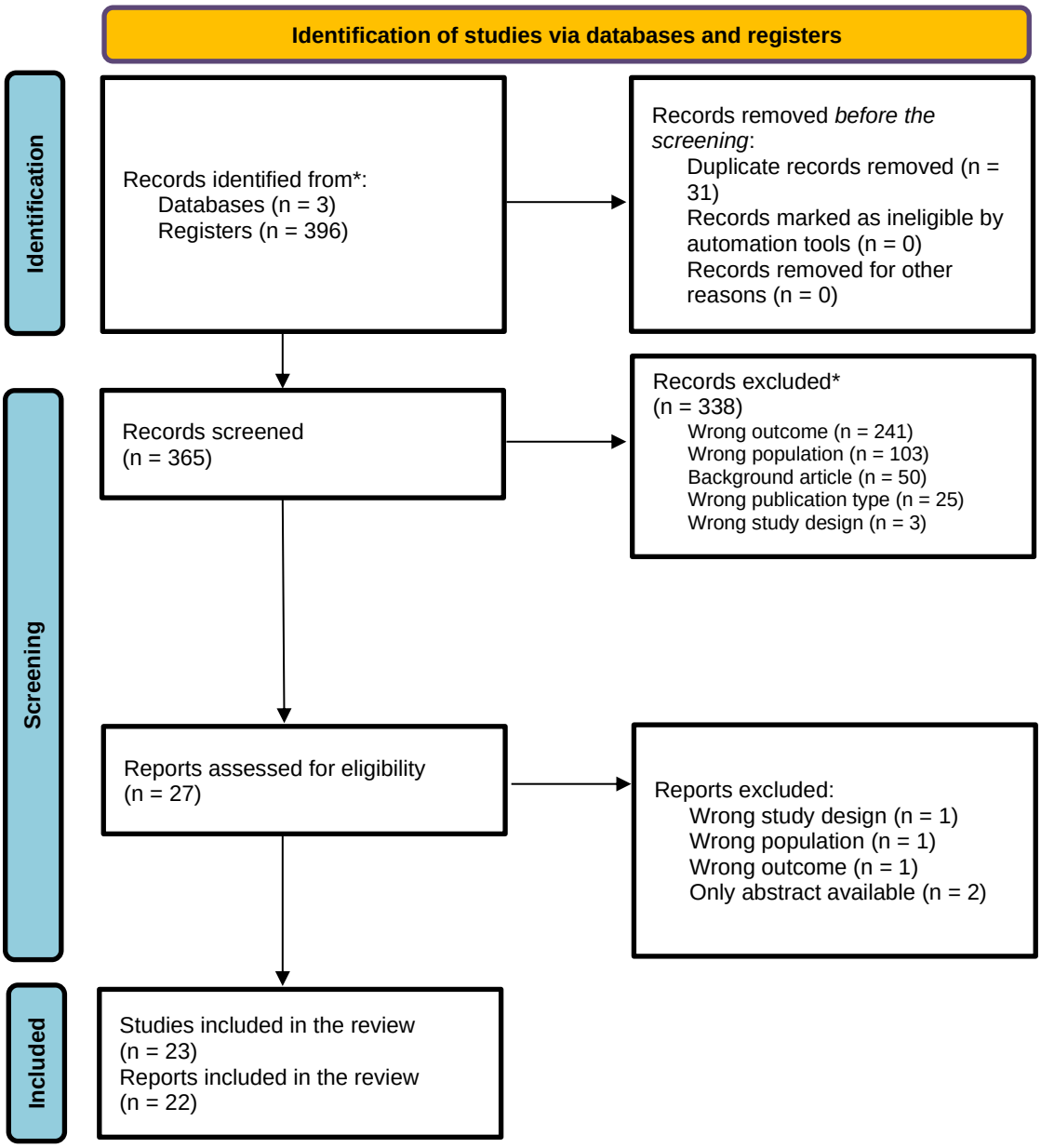

*Figure 1 – Study flow diagram. * Each study might have more than one reason to be excluded. Adapted from: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71*

Study	Methods	Sample Size	Population	Intervention	Outcome(s)	Relevant findings
Wills, Backett-Milburn, Gregory, & Lawton, 2006	Qualitative Study: Screening questionnaire + interview; Setting: socio-economically disadvantaged circumstances in Eastern Scotland	N (total) = 36; N (females) = 18; N (males) = 18	Age range: 13-14 years; N [overweight (BMI > 25) or obese (BMI > 30) = 18]; Ethnicity: not reported.	not applied	Embodied experiences of 'normal' weight, overweight and obese teenagers	AOO were restricted in what clothes they were able to buy and wear. AOO had fear of trying on clothes in front of other thinner peers, which restricted shopping trips with friends.
Latner, Rosewall, & Simmonds, 2007	Cross-Sectional Surveys: 3 parts questionnaire; Weekly time spent watching television, watching video games, and reading magazines on weekdays and weekends was assessed; Setting: Christchurch - New Zealand.	N (total) = 261; N (females) = 171; N (males) = 90	Age range: 10-13 years; BMI = 14.53-32.05 kg/m^2 (M = 19.84 ± 3.55 kg/m^2), normal weight range (5th percentile to <85th percentile) = 70.3%, at riskk of overweight (85th to <95th percentile) = 18.1%, overweight (95th percentile or greater) = 11.6%; Ethnicity: 77.0% New Zealand European or other Caucasian, 11.5% Asian or part Asian, 7.7% Maori or part Maori, .8% African and .8% Pacific Islander or part Pacific Islander, 2.2% did not report.	not applied	Sex, ethnicity, and age differences; media and BMI; media exposure and stigma	Greater dislike of obese children relative to their non-overweight peers was uniquely predicted by magazine reading time.
Bodiba, 2008	Quantitative (Rosemberg Self-esteem Measure and Pearson correlation) + qualitative (ANOVA and phenomenological principle of open coding for the thematic analysis)	N (total) = 75; N (females) = 75; N (males) = 0	Age range= 17-19 (M = 16); BMI: M = 23.21 ± 4.486 kg/m^2, overweight (BMI > 25 kg/m^2) = 24%, M = 29.65 ± 3.697 kg/m^2; Ethnicity: black South Africans	not applied	Attitudes, feelings and needs regarding their body mass; Social limitations encountered as a result of their body mass; Feeling that are in relation to the way the media emphasize	Low self-esteem was perceived to be aggravated by several factors, like the attitude of the media and society; Overweight participants appointed they faced limitations in terms of fashion clothes and popular designer labels regarding their body mass.

	methods; South Africa.				weight loss; Relationship between body mass and self-concept; Differences in self-concept depending on BMI.	
Lin & Reid, 2009	Cross-Sectional Surveys; Weekly amount of time spent watching television and reading fashion magazines was assessed; Setting: Northeast United States.	N (total) = 112; N (females) = 112; N (males) = 0	Age range: 18-29 years (M=20.27, SD = 1.52); BMI = 18.0 - 36.9 kg/m^2 (M=23.20 ± 3.69 kg/m^2); Ethnicity: 79% Caucasian, 7% Asian/Pacific Islander, 5% Hispanic/Latina, 5% Black/African–American, 3% mixed race, and 1% did not report	not applied	The relationship between media exposure, antifat attitudes, body dissatisfaction, and the mediating effect of dysfunctional appearance beliefs.	Time spent reading fashion magazines was positively correlated with antifat attitudes and this relationship was mediated by dysfunctional beliefs about appearance; BMI and antifat attitudes are negatively related.
Martínez-Aguilar et al., 2010	Qualitative Study: Interview; Setting: Matamoros, a city in Tamaulipas, Mexico	N (total) = 24; N (females) = 14; N (males) = 10.	Age range = 11 - 15 years; BMI was ≥ 95th percentile; Ethnicity: not reported.	not applied	Definition of obesity and aetiology; Perception and feelings produced by obesity; Limitations imposed by obesity; Rejection by peers; Psychological defence mechanisms against obesity; Management.	Physical appearance and body image are important aspects for adolescents: the participants appointed difficulties to find their clothes in their size or that make them see themselves positively. They even indicated that this situation makes them feel depressed; One adolescent mentioned going jogging as an action to improve her/his physical appearance (as look good in her trousers).

Maffiuletti, Malatesta, Agosti, & Sartorio, 2012	Self-controlled study; Inclusion criteria were age ≥ 18 years; body mass index ≥ 30 kg/m(-2); and absence of severe and uncontrolled hypertension, overt uncompensated diabetes, and any neurologic, orthopaedic, or psychiatric disorder; Setting: Italy.	N (total) = 29; N (females) = 19; N (males) = 10.	Age range: 18 - 45 years (M = 29.6, SD = 8.5); BMI = 30 - 60 kg/m^2 (M = 43.0 ±5.9 kg/m^2); Ethnicity: not reported	Stand quietly and walk at preferred walking speed while wearing unstable VS conventional shoes.	The metabolic rate of standing and gross and net energy cost of walking.	It is possible to increase standing and walking energy expenditure using ergonomic unstable footwear. Long-term use of unstable shoes may eventually prevent a positive energy balance.
James, Pobee, Oxidine, Brown, & Joshi, 2012	Qualitative Study: Focus groups; The Health Belief Model was used as the study's theoretical framework; Setting: USA.	N (total) = 50; N (females) = 50; N (males) = 0.	Age range: 18 - 64 years (24 % were 18-24 years); BMI = ≥ 25 kg/m^2 (BMI 25 - 29.9 kg/m^2 = 64 %; BMI ≥ 30 kg/m^2 = 34%); Ethnicity: African-American	not applied	Defining areas that should be addressed when developing culturally appropriate weight-loss messages, programs, and materials for African-American women.	The perceived benefits of losing weight included improved physical/personal appearance ("I want to get back into short shorts", "I am tired of having to worry about a whole new wardrobe", "It affects my self-image, you know. I want to feel like I look good to myself, nobody else") and living life to the fullest; Motivators to lose weight included, also, physical appearance, and saving money on clothes; Obesity also limits wardrobe options: "You can't buy the really nice clothes", "You're limited to stretch pants that show your dimples."
Nafiu & Burke, 2013	Prospective, cross-sectional observational, nonrandomized, nonblinded design; Setting: children scheduled for elective noncardiac operations at a tertiary teaching hospital; Setting: USA.	N (total) = 725; N (females) = 348; N (males) = 377.	Age range: 6 - 18 years (M = 10.8, SD 3.7); BMI ≥ 85th percentil (classified as overweight/obese) = 31.4 %; Ethnicity: 82% caucasian, 18% not reported.	not applied	Indices of adiposity; rates of medical comorbidities.	Large clothing size was strongly associated with high BMI category (overweight/obesity); Children who usually wore large clothing size (CSz) for age were more likely to have some obesity-related diagnoses (including habitual snoring, OSA, bronchial asthma, and elevated blood pressure); CSz greater than +2 size was associated with at least 2x increased odds for the presence of 1 or + of these obesity-related health risks.
Jeffers, Cotter, Snipes, & Benotsch, 2013	Cross-Sectional Surveys: online. Measures: Demographics;	N (total) = 743; N (females) = 516; N	Age range: 18 - 25 years (M = 18.85 ± 1.41 years); BMI: M = 23.55 ± 4.46	not applied	Depressive symptoms.	BMI was significantly correlated with media pressure, and media pressure was significantly correlated with depressive

	The Sociocultural Attitudes Toward Appearance Scale-3 (SATAQ-3); Center for Epidemiologic Studies Depression Scale-Revised (CESD-R); Setting: Mid-Atlantic University - USA.	(males) = 227.	kg/m^2; Ethnicity: Caucasian (49.3%), African American (23.4%), Asian American (14.2%), Hispanic/Latino (6.0%), other racial/ethnic category (6.6%), and Native American (0.5%).			symptoms. BMI was not associated with depressive symptoms.
Jiménez-Ormeño, Aguado, Delgado-Abellán, Mecerreyes , & Alegre, 2013	Cross-sectional study; Measurements of foot morphology were obtained with a three-dimensional feet digitizer in static standing; Setting: Toledo province.	N (total) = 1032; N (females) = 535; N (males) = 497.	Age range: 6 - 12 years; BMI: normal-weight (<25 kg/m^2) = 65.79 % (679 children), overweight (≥25 <30 kg/m^2) = 24.22% (250 children), obese (≥30 kg/m^2) = 9.98% (103 children); Ethnicity: not reported.	not applied	Foot morphology based on their BMI and age; child's foot development.	Increased BMI affects foot morphology changes with age. Manufacturers using these data can make new lasts based on age and weight for children's shoes using this technology.
Felicitas et al., 2015	Prospective observational cohort study; Detailed design and sampling procedures, including questionnaire development; Data Collected between 2002 and 2005. Three waves of data (2002, 2003, 2004) were analyzed for this study; Setting: Mainland China (Chengdu, Hangzhou, Shenyang, Wuhan, Harbin, Kunming, Qingdao).	N (total) = 5020; N (females) = 2622; N (males) = 2398.	Age at baseline: Females [M = (12.6 ± 0.6) - (15.06 ± 0.6) years], Males [M = (12.8 ± 07) - (15.9 ± 06) years]; Overweight at baseline: N = 355 (27.2%); Those deemed to be overweight or obese had a BMI at or greater than the 85th and 95th percentile of age-gender-specific BMI; Ethnicity: not reported.	not applied	General Adiposity (reflected by a proxy measure of body mass index); Central adiposity (described by waist circumference)	Significant decrease in BMI over time among middle and high school girls with greater exposure to foreign media at baseline; High school girls who placed greater importance on appearance at baseline were shown to have significantly lesser odds of being overweight.
Shentow-Bewsh, Keating, & Mills, 2016	Randomized Controlled Trial. Measures: Negative Affect	N (total) = 120; N (females) = 120; N (males) = 0.	Age range: 17 - 57 years (M = 20.35 ± 4.70 years); BMI range = 16.21 - 38.65	Anti-obesity condition read vs sun exposure condition read	Mood; Hunger; Self-esteem; Body Image; Perceived sociocultural	Participants higher in perceived pressure to be thin tended to experience greater reductions in body esteem; For women who

	subscale of the Positive and Negative Affect Scale-Expanded (PANAS-X); Current Thoughts Scale; The Body Esteem Scale; The Perceived Sociocultural Pressure Scale; To assess participants' reactions to the fictitious media articles, they were asked to complete a questionnaire; Setting: York University - Canada.		kg/m^2 (M = 24.05 ± 4.58), BMI ≥ 25 kg/m^2 = 30.8%; Ethnicity: 25.8% White/Caucasian, 16.7% Black/African American, 25% Asian, 1.7%Hispanic/Latino, 4.2% Biracial & 25.8%other ethnic identification, 1 participant did not report.	(first control condition) vs complete a word search (second control condition).	pressure (PSP); Representativeness of media articles.	normally feel strong social pressure to be thin, reading anti-obesity messages may further increase their concerns about their weight; Reading about the negative effects of obesity may lead heavier women to suppress their food intake
Trovato et al., 2016	Prospective cohort study; Setting: Catania - Italy.	N (total) = 708; N (females) = 458; N (males) = 250.	Age range: 15 - 35 years (M = 21.72 ± 3.71 years); BMI: M= 22.47 ± 3.43 kg/m^2 (BMI > 30 kg/m^2 defines overweight/obesity); Ethnicity: not reported.	not applied	BMI; fashion and size-preferred clothes.	As regards oversized clothing, the only significant difference is the greater BMI in Non-alcoholic fatty liver disease (NAFLD) subjects.
Woolford et al., 2016	Qualitative study: focus groups; Quantitative study: cross-sectional survey (Ethnic, Physical Activity, Demographic Data, Hair Characteristics, Styles and Preferences); Setting: Michigan, Georgia and California; Data Collected: Summer 2011.	N (total) = 36; N (females) = 36; N (males) = 0.	Age range: 14 - 17 years (M = 20.35 ± 4.70 years); BMI range = 16.7 - 52.7 kg/m^2 (M = 24.7 25 kg/m^2), 16.6% classified as overweight and 16.6% as obese; Ethnicity: African American.	not applied	Barriers to engaging in physical activity: the role of hairstyle choices in physical activity (PA), and preferences for particular hairstyles.	Preference for straight hair may contribute to African American adolescent (AAA) girls avoiding certain activities due to concerns about sweat affecting their hair; Ethnic identity (EI) and hairstyle choice appear to be associated with levels of physical activity (PA) for some participants.
Goldfield et al., 2016	Cross-sectional study;	N (total) = 358; N	Age range: 14 - 18 years (M =	not applied	Depressive symptoms	Screen time (ST) may impact depressive

	Assessments, including physical examination and questionnaires; Data collected between 2005 and 2010; Setting: Ottawa/Gatineau, Canada region; Only participants who were post-pubertal (Tanner stage IVor V) were included.	(females) = 261; N (males) = 97.	15.6 ± 1.4); BMI: M = 34.5 ± 4.5 kg/m^2, all participants were either overweight (85th to 94th BMI percentile) or obese (≥ 95th BMI percentile), 93% classified as obese; Ethnicity: (71 %) was Caucasian, 11 % were African-Canadian, 3 % Arabic, 3 % Hispanic, 3 % Asian, 2 % First Nations, 5 % mixed race, and 2 % categorized as "other".		(subclinical symptoms).	symptoms through the content of the media exposure, the situation, or the messages. For example, the association we found between computer use and depressive symptoms could have been due to youth repeatedly comparing themselves to idealized but unattainable images.
Wyssen, Coelho, Wilhelm, Zimmermann, & Munsch, 2016	Randomized multi-site cross- and longitudinal experimental trial; Eating Disorder Examination Questionnaire (EDE-Q; German version; Visual Analog Scale Body Image Satisfaction (VAS-BIS); BriefMood Scale (BMS); Thought-Shape Fusion Body State Scale (TSF-B state).	N (total) = 91; N (females) = 91; N (males) = 0.	Age range: 18 - 30 years (M = 21.9 ± 2.0); BMI range = 16.8 - 30.0 kg/m^2 (M = 21.7 ± 2.4 kg/m^2), 5.5% classified as overweight (BMI > 25 kg/m^2); Ethnicity: 39.6% of the participants were Swiss, 52.7% were German, and 7.7% had another nationality.	Thin-ideal group (exposure to a fashion magazine representing the thin ideal and subsequent vivid imagination of the female bodies) vs control group (exposure to a nature magazine and subsequent vivid imagination of landscapes)	Body image; affect; eating behaviour; physiological stress response	Short media exposure to a fashion magazine in a waiting room did not influence mood or body image satisfaction (BIS); body-related cognitive distortions (TSF-B) in terms of perception of weight gain, fatness and moral wrongdoing were activated through the vivid imagination of thin ideals seen in a magazine; self-reported urges to restrict food intake were evoked.
Rubinstein et al., 2017	Randomized Controlled Trial; Setting: Israel.	N (total) = 41; N (females) = not reported; N (males) = not reported.	Age: M = 9.9 years; BMI: M= 95.7th ± 3.6 percentile, overweight and obese (BMI > 85 percentile) = 31 children; Ethnicity: not reported.	Overweight and obese group vs Normal-weight group; Walking and running at different speeds.	Biomechanical characteristics of gait pattern; foot pressure; maximum force.	Overweight and obese children manifested different gait parameters, such as elongation of cycle length, increased cycle time, and a longer relative double-support phase; along with increased peak pressure and increased maximum force.
	Qualitative	N (total) = 51; N	Age: M = 10.4; BMI: 2.0% were	not applied	Ideal body image; body	Children formed their body

Heidelberger & Smith, 2018	(focus groups) and quantitative (body image assessment instruments); ; Setting: Midwestern United States.	(females) = 25; N (males) = 26. Of the 51 children enrolled in the study, only 46 children completed both the focus group and survey, while 51 completed the survey.	underweight (< 5th BMI-for-age), 29.4% were healthy weight (5–85th %), 27.5% were overweight (85–95th), and 41.2% were obese (> 95th); Ethnicity: African American (53%) and American Indian (47%).		dissatisfaction; type of instrument preferred by children (Figure Rating Scale (FRS/silhouette) instrument vs Children's Body Image Scale).	image perception with influence from their parents and the media; Children have experienced negative consequences related to poor body image (such as disordered eating habits, depression, and bullying); Children prefer that the images on a body image assessment tool have detailed facial features and are clothed (Figure Rating Scale instrument); Children reported that having a sense of style as one of the most important qualities when choosing a friend.
Oldham, Tomiyama, & Robinson, 2018 (Study 1)	Randomized Controlled Trial; Setting: not reported.	N (total) = 120; N (females) = 120; N (males) = 0.	Age range: 18 - 46 years (M = 19.97 ± 3.77); BMI range = 16.59 - 30.62 kg/m^2 (M = 22.40 ± 2.90 kg/m^2); Ethnicity: not reported.	Obese body suit public vs obese body suit private vs control public vs control private.	Affect; Hunger; Implicit Association Task (IAT); Self-Presentation Concerns; Body Satisfaction; Dietary Restraint;	Participants ate more when wearing the obese body suit than when wearing the control clothing; The setting did not affect consumption and the interaction between clothing and setting was not significant; Whilst wearing the obese body suit resulted in reduced positive affect, greater negative affect and greater self-presentation concerns, these variables did not mediate the relationship between clothing condition and snack food consumption.
Oldham, Tomiyama, & Robinson, 2018 (Study 2)	Randomized Controlled Trial; Setting: not reported.	N (total) = 150; N (females) = 80; N (males) = 70.	Age range: 18 - 30 years (M = 20.13 ± 2.56); BMI range = 16.84 - 34.26 kg/m^2 (M = 23.32 ± 3.37 kg/m^2); Ethnicity: not reported.	Obese body suit public vs control public; effect discriminated by gender.	Affect; Hunger; Implicit Association Task (IAT); Self-Presentation Concerns; Body Satisfaction; Dietary Restraint; Emotional regulation; gender influence.	The psychosocial experience of feeling overweight leads to increased snack food consumption in women, but not men; None of the proposed mediators that were affected by the clothing condition (body anxiety, self-esteem, self-presentation concerns, explicit perception of overweight, effortful self-control and negative affect) was associated with food consumption.
Sundar et al., 2020	Mixed methods, with a convergent design. Quantitative post-intervention	Quantitative post-intervention data on HRQoL: N (total) = 84; Qualitative	Quantitative post-intervention data on HRQoL: age range = 13-14 years; Norwegian reference	not applied	Health-related quality of life (HRQoL); BMI; PA.	Most of the interviewees expressed a negative view of their bodies, but not their clothing or accessories; The use of the KIDSCREEN 52 instrument

	data on HRQoL using the KIDSCREEN 52 questionnaire. Data were compared with a Norwegian reference population & analysed using a non-parametric Mann-Whitney test. Qualitative semi-structured interviews were conducted from the intervention. A directed approach to content analysis was adopted, using the 10 sub-scales from KIDSCREEN 52.	semi-structured interviews: N (total) = 21 from the intervention ; Norwegian reference population: N (total) = 244.	population: age range = 13-14 years. Included participants had BMI > 25 kg/m^2. Ethnicity: not reported.			gave important indications about the adolescents' HRQoL and need for additional follow up.
Bennett, Wagner, Obleada, & Latner, 2020	Cross-Sectional Surveys: questionnaires online. Measures: demografic data; Goldfarb Fear of Fat Scale (GFFS); Universal Measure of Bias–fat (UMB–FAT); Composite score of time spent using various appearance-focused media; Setting: University of Hawaii.	N (total) = 187; N (females) = 187; N (males) = 0.	Age: M = 21.05 ± 3.72 years; BMI: M = 22.60 ± 4.39 kg/m^2); normal weight range 70.6%, overweight 10.2%, underweight 9.1%, obese 8.0%, & did not report 2.1%; Ethnicity: Asian 58.8%, White 23.5%, Pacific Islander/Hawaiian 6.4%, Mixed Ethnicity 4.8%, Hispanic 4.3%, Native American 0.5%, & African American 0.5%.	not applied	Fear of fat; weight bias.	Fear of fat was significantly, positively related to weight bias; Appearance-focused media use and fear of fat significantly predicted weight bias; Body mass index was not significantly associated with fear of fat, weight bias, or media use.
Llauradó et al., 2021	The present study was part of the EYTO project, a multicentre social marketing intervention; Setting: Spain, the Czech Republic (CZ) and Portugal and the United Kingdom (UK). Data were collected during 12 months.	N (total) = 18; N (females) = 18; N (males) = 0.	Age range: 13-15 years; BMI: not reported; Ethnicity: not reported	Peer leader training: social media (Facebook, Twitter, Instagram, YouTube, Website (blog), online promotional videos); Type of intervention: face-to-face activities, pop-up events, posters and leaflets,	Confidence in managing tasks; confidence and experience in communication tasks (including social media use).	The peer leaders improved their confidence in management tasks and their confidence and experience in communication tasks.

		seminars, merchandise, web-based activities, sports lessons.

Table 1 – Characteristics of all included studies in the review.

Study design and geographical location

In this review, it was included 7 cross-sectional studies (CS), 5 randomised controlled trials (RCT), 4 mixed methods research (MM) (qualitative and quantitative), 3 qualitative studies (QS), 2 prospective observational cohort studies (CohS), 1 multicentre social marketing intervention (SMI), 1 self-controlled study (SCS). Of the 23 studies, 6 were conducted in the United States of America (USA), 2 in Canada, 2 in Spain, 2 in Italy and one each in Eastern Scotland, New Zealand, South Africa, Mexico, China, Georgia, Swiss, German, Israel, Norway, Hawaii, Czech Republic (CZ), Portugal and United Kingdom (UK). From the 23 studies included, 3 studies did not report the geographical location.

Population characteristics

For 13 (56.2% of the studies included) of the 23 included studies, outcome data for adolescents with obesity or overweight were not published separately from data for the total study population. Although, the mean age in 2 (Jeffers, Cotter, Snipes, & Benotsch, 2013; Nafiu & Burke, 2013) of the 13 studies was in the range of adolescent age range. I, therefore, contacted the study authors to obtain the unpublished data, but without success. The same was done regarding another study (Llauradó et al., 2021) that did not report BMI. After full consideration and discussion with the tutor, the study was included as an example of a possible relevant approach to adolescents with overweight and obesity. Also, 2 studies did not mention the criteria to define overweight and obesity (Bennett et al., 2020; Woolford, Woolford-Hunt, Sami, Blake, & Williams, 2016). Although, these studies specify the percentage of adolescents overweight and obese.

The total number of participants included in this review was 10,008. The overall proportions of girls and boys with obesity or overweight were 59% (N = 5876) and 41% (N = 4070), respectively. Two studies did not specify gender (Rubinstein et al., 2017; Sundar et al., 2020): 1% of the participants (N = 62).

The majority of studies reported the following ethnic groups: Caucasian (N = 9 studies), African American (N = 8 studies), Hispanic/Latina (N = 5 studies), Asian (N = 4 studies),

Mixed (N = 4 studies), other racial/ethnic category (N = 4 studies), Native American (N = 2 studies), Arabic (N = 1 study), First Nations (N = 1 study), Maori (N = 1 study), Asian American (N = 1 study), African (N = 1 study), South African (N = 1 study), African Canadian (N = 1 study) and American Indian (N = 1 study). In 17 studies were mentioned that ethnicity was not reported.

Intervention characteristics

The interventions fell into 2 categories:

1. Physical activity (N = 2 studies);
2. Psychosocial interventions, including social media education (N = 5 studies);

Table 1 provides an overview of the specific intervention content.

Physical activity

Interventions classified as physical activity interventions comprised the following meanings:

1. Non-exercise activity wearing unstable shoes (Maffiuletti, Malatesta, Agosti, & Sartorio, 2012);
2. Walking and running at different speeds (Rubinstein et al., 2017).

Maffiuletti et al., 2012 was the only study that compares the influence of different types of shoe design on non-exercise activity thermogenesis in adolescents with obesity BMI = 30 - 60 kg/m^2 (M = 43.0 ±5.9 kg/m^2) while suggesting a new intervention to obesity treatment and prevention while involving the footwear segment of the fashion industry into this global problem in this special population.

The interventions (Maffiuletti et al., 2012; Rubinstein et al., 2017) differed substantially in the age range. Maffiuletti et al., 2012 featured a much older sample than Rubinstein et al., 2017.

Psychosocial interventions

The studies classified into this category included:

1. Social media interventions (Llauradó et al., 2021; Shentow-Bewsh, Keating, & Mills, 2016; Wyssen, Coelho, Wilhelm, Zimmermann, & Munsch, 2016);

2. Psychosocial experience of feeling overweight (Oldham, Tomiyama, & Robinson, 2018).

Studies under the classification of social media interventions covered interventions with exposure to social media related to appearance (Shentow-Bewsh et al., 2016; Wyssen et al., 2016) and training in social media (Llauradó et al., 2021). Regarding the studies under the exposure to social media related to appearance intervention, both only included females, as well as, university students. The studies differed substantially in the percentage of participants with BMI > 25 Kg/m^2: one study included 30.8% of participants with a BMI of at least 25 Kg/m^2 (Shentow-Bewsh et al., 2016); the other included 5.5% of participants with BMI > 25 Kg/m^2 (Wyssen et al., 2016). Also, the studies differed in ethnicity included: there were a greater variety of ethnicities in Shentow-Bewsh et al., 2016 when compared to Wyssen et al., 2016 study. Regarding the study subclassified as training in social media (Llauradó et al., 2021), it was carried out in a much younger population (13-15 years old) and school-based.

The intervention subclassified as the psychosocial experience of feeling overweight (Oldham et al., 2018) was reported in the same journal article where was published two studies: one exclusively done with females and another with females plus males. In the last one, the results were specified for each gender.

Comparison conditions

In the experimental studies, regardless of the intervention type, 4 studies compared the intervention with a control group and 1 study did not define a control group (Llauradó et al., 2021). In this last study, the authors compared baseline and end-of-study data results. Also, they compared results between peers from different countries (Spain, CZ, Portugal and UK). All 4 studies with the control group applied a control condition offering a similar intervention to the intervention group:

1. Anti-obesity condition read (intervention) versus reading about other subjects (control group)(Shentow-Bewsh et al., 2016; Wyssen et al., 2016). In one study (Shentow-Bewsh et al., 2016), the intervention was a multidimensional weight-stigmatizing article, including a narrative regarding the appearance negative effects of obesity on physical health, social status, and appearance; while having

2 control groups: the sun exposure control condition (intended to control for the potential effects of reading about the negative consequences of any dangerous health condition); neutral, unrelated control condition (word search). In the other study (Wyssen et al., 2016), the intervention group was the thin-ideal group (i.e., exposure to a fashion magazine representing the thin ideal and subsequent vivid imagination of the female bodies); in the control group, participants were exposed to a nature magazine and subsequent vivid imagination of landscapes;

2. Wearing unstable shoes (intervention group) versus conventional shoes (control group (Maffiuletti et al., 2012);
3. Overweight and obese group (intervention group) versus normal-weight group (Rubinstein et al., 2017);
4. In one study (Oldham et al., 2018), the authors compared participants wearing an obese body suit versus wearing control clothing in public or private settings (standard clothing was identical to that worn in the obese body suit condition and participants wearing standard clothing were asked to select a clothing size that would fit best over their clothes). Also, comparisons between gender were carried out.

Primary outcomes

Data were available for the following primary outcomes in both observational and experimental studies:

1. *Health-related quality of life* (Heidelberger & Smith, 2018; D. C. S. James, Pobee, Oxidine, Brown, & Joshi, 2012; Sundar et al., 2020);
2. *Behaviour Change/Overcome challenges/treatment compliance* (Felicitas et al., 2015; Latner, Rosewall, & Simmonds, 2007);
3. *Changing nutrition choices/eating-related behaviours* (Heidelberger & Smith, 2018; Oldham et al., 2018; Shentow-Bewsh et al., 2016; Wyssen et al., 2016);
4. *Symptoms of depression* (Goldfield et al., 2016; Jeffers et al., 2013);
5. *Patient-reported adverse events*.

Regarding the primary outcomes established in this systematic review, only *patient-reported adverse events* were not reported as outcomes. Also, regarding the outcome of *behaviour change/overcome challenges/treatment compliance*, 2 studies were more related to *behaviour change* (Felicitas et al., 2015; Latner et al., 2007).

Secondary outcomes

Data in both observational and experimental studies were available for the following secondary outcomes:

1. *Body mass* (Bennett et al., 2020; Felicitas et al., 2015; Jeffers et al., 2013; Nafiu & Burke, 2013; Trovato et al., 2016);
2. *Physical Activity, Physical Exercise and Physical Performance* (Jiménez-Ormeño, Aguado, Delgado-Abellán, Mecerreyes, & Alegre, 2013; Maffiuletti et al., 2012; Martínez-Aguilar et al., 2010; Rubinstein et al., 2017; Woolford et al., 2016);
3. *Emotional functioning* (Bennett et al., 2020; Bodiba, 2008; Felicitas et al., 2015; Goldfield et al., 2016; Heidelberger & Smith, 2018; James et al., 2012; Lin & Reid, 2009; Martínez-Aguilar et al., 2010; Oldham et al., 2018; Shentow-Bewsh et al., 2016; Sundar et al., 2020; Wyssen et al., 2016);
4. *Social functioning*, including *stigma* (Bodiba, 2008; Heidelberger & Smith, 2018; D. C. S. James et al., 2012; Latner et al., 2007; Lin & Reid, 2009; Llauradó et al., 2021; Martínez-Aguilar et al., 2010; Oldham et al., 2018; Wills et al., 2006);
5. *School functioning* (Llauradó et al., 2021);

For the population specified in this review, the following outcomes did not show results: *skin conductance responses*, *heart rate*, *electrophysiological responses* and *markers of inflammation*.

Body mass

Regarding the *body mass* outcome, 3 studies presented *social media pressure* as the outcome (Bennett et al., 2020; Felicitas et al., 2015; Jeffers et al., 2013) and 2 studies presented *large clothing size* (Nafiu & Burke, 2013; Trovato et al., 2016).

Physical Activity, Physical Exercise and Physical Performance

For this outcome, 2 studies were related to *changes in biomechanical characteristics* (Jiménez-Ormeño et al., 2013; Rubinstein et al., 2017); 1 study was related to *changes in metabolic rate* (Maffiuletti et al., 2012); 1 study with the *willingness to perform physical activity* as the outcome (Martínez-Aguilar et al., 2010); 1 study was related to *the influence of hairstyle choices in physical activity* (Woolford et al., 2016).

Emotional functioning

Specifying this general outcome here was included: in 2 studies under the same report (Oldham et al., 2018) with *positive and negative affect* as outcomes (Oldham et al., 2018); 2 studies measured *self-esteem* (Bodiba, 2008; Shentow-Bewsh et al., 2016); *body image* was an outcome in 13 studies (Bennett et al., 2020; Bodiba, 2008; Felicitas et al., 2015; Goldfield et al., 2016; Heidelberger & Smith, 2018; D. C. S. James et al., 2012; Lin & Reid, 2009; Oldham et al., 2018; Shentow-Bewsh et al., 2016; Sundar et al., 2020; Wills et al., 2006; Wyssen et al., 2016) and this classification included terms as *body image*, *body satisfaction*, *body image satisfaction*, *body dissatisfaction*, *body-related cognitive distortions*, *dysfunctional beliefs about appearance* and *physical appearance*; *fitting into different clothes* was an outcome in 5 studies (Bodiba, 2008; Martínez-Aguilar et al., 2010; Oldham et al., 2018; Wills et al., 2006).

Social functioning

Social functioning related outcomes were: *social limitations* (Bodiba, 2008; D. C. S. James et al., 2012; Martínez-Aguilar et al., 2010) – 3 studies; 5 studies measured *stigma* as the outcome (Latner et al., 2007; Lin & Reid, 2009; Oldham et al., 2018; Wills et al., 2006); *antifat attitudes* – 2 studies (Bodiba, 2008; Lin & Reid, 2009), including the influence of *sense of style when choosing a friend* – 1 study (Heidelberger & Smith, 2018) and *dislike of obese children by peers* – 1 study (Latner et al., 2007); *management tasks* – 1 study (Llauradó et al., 2021); *communication tasks, including social media use* – 1 study (Llauradó et al., 2021); *save money on clothes* – 1 study (D. C. S. James et al., 2012); *bullying* – 1 study (Heidelberger & Smith, 2018).

School functioning

School functioning related outcomes were: *management tasks* – 1 study (Llauradó et al., 2021); *communication tasks, including social media use* – 1 study (Llauradó et al., 2021).

Risk of bias in included studies

The included studies (experimental and observational) were evaluated for risk of bias and Figure 2 shows the review authors' judgements for each included study and the supporting study. Judgements from the risk of bias assessment are summarized under Supplementary data (Table S2).

Effects of Interventions

We identified one intervention in different studies that measured the same outcomes, which is the *Psychosocial Experience of feeling overweight* intervention (Oldham et al., 2018). Therefore, we conducted a meta-analysis for these studies.

Risk-of-bias Tool	Research Designs	Study ID	Outcome	D1	D2	D3	D4	D5	Overall	
RoB 2	1SCS	Maffiuletti, Malatesta, Agosti, & Sartorio, 2012	Changes in Metabolic Rate	+	+	+	+	!	!	
RoB 2	1RCT	Shentow-Bewsh, Keating, & Mills, 2016	Behaviour change; Emotional functioning; Food Behaviour	+	+	+	+	+	+	
RoB 2	2RCT	Wyssen, Coelho, Wilhelm, Zimmermann, & Munsch, 2016	Emotional functioning; Food Behaviour	+	+	+	+	!	!	
RoB 2	3RCT	Rubinstein et al., 2017	Physical activity	!	+	+	+	+	!	
RoB 2	4RCT	Oldham, Tomiyama, & Robinson, 2018 (Study 1)	Food Behaviour; Emotional functioning	+	!	+	+	+	!	
RoB 2	5RCT	Oldham, Tomiyama, & Robinson, 2018 (Study 2)	Food Behaviour; Emotional functioning	+	!	+	+	+	!	
RoB 2	1SMI	Llauradó et al., 2021	Social functioning; School functioning	-	+	+	+	+	-	
EPHPP Criteria	1QS	Wills, Backett-Milburn, Gregory, & Lawton, 2006	NA						!	Criteria: Study Design (Weak)
EPHPP Criteria	1CS	Latner, Rosewall, & Simmonds, 2007Latner, Rosewall, & Simmonds, 2007	NA						!	Criteria: Study Design (Weak)
EPHPP Criteria	1MM	Bodiba, 2008	NA						-	Criteria: Study Design (Weak), Blinding (Weak)
EPHPP Criteria	2CS	Lin & Reid, 2009	NA						!	Criteria: Study Design (Weak)
EPHPP Criteria	2QS	Martínez-Aguilar et al., 2010	NA						!	Criteria: Study Design (Weak)
EPHPP Criteria	3QS	James, Pobee, Oxidine, Brown, & Joshi, 2012	NA						!	Criteria: Study Design (Weak)
EPHPP Criteria	3CS	Nafiu & Burke, 2013	NA						!	Criteria: Study Design (Weak)
EPHPP Criteria	4CS	Jeffers, Cotter, Snipes, & Benotsch, 2013	NA						-	Criteria: Study Design (Weak), Confounders (Weak)
EPHPP Criteria	5CS	Jiménez-Ormeño, Aguado, Delgado-Abellán, Mecerreyes, & Alegre, 2013	NA						!	Criteria: Study Design (Weak)
EPHPP Criteria	1CohS	Felicitas et al., 2015	NA						!	Criteria: Confounders (Weak)
EPHPP Criteria	2CohS	Trovato et al., 2016	NA						+	Criteria: no weak
EPHPP Criteria	2MM	Woolford et al., 2016	NA						!	Criteria: Study Design (Weak)
EPHPP Criteria	6CS	Goldfield et al., 2016	NA						-	Criteria: Study Design (Weak), Selection bias (weak)
EPHPP Criteria	3MM	Heidelberger & Smith, 2018	NA						!	Criteria: Study Design (Weak)
EPHPP Criteria	4MM	Sundar et al., 2020	NA						!	Criteria: Study Design (Weak)
EPHPP Criteria	7CS	Bennett, Wagner, Obleada, & Latner, 2020	NA						!	Criteria: Study Design (Weak)

+ Low risk
! Some concerns
- High risk

D1 Randomisation process
D2 Deviations from the intended interventions
D3 Missing outcome data
D4 Measurement of the outcome
D5 Selection of the reported result

Figure 2 – Risk of bias summary: review authors' judgements about each risk of bias item for each included study (blank cells indicate that the particular domain was not assessed for the study). CS: Cross-sectional studies; RCT: Randomised Controlled Trials; MM: Mixed Methods Research; QS: Qualitative Studies; CohS: Observational Cohort Studies; SMI: Social Marketing Intervention; SCS: Self-Controlled Study.

Primary outcomes

Comparison 1: Obese Body Suit versus Control Clothing

Two studies (Oldham et al., 2018) delivered *Psychosocial Experience of feeling overweight* interventions (wearing obese body suits) and compared them to a control clothing group as explained in the *comparison conditions section* in this review. These two studies provided suitable data for inclusion in meta-analyses. Data were available for the outcome of *eating-related behaviours*.

Eating-related behaviours

Eating-related behaviour reported in studies was *snack food consumption*. Two studies (Oldham et al., 2018) were included that used the same test to measure food consumption: Bogus Taste Test (Robinson et al., 2017). We, therefore, extracted data from the studies as mean and standard deviations.

Meta-analysis findings

To perform the meta-analysis, we selected only the results from the public setting to maintain accuracy between studies 1 and 2, since study 2 only evaluated interventions in the public setting. For the same reason, in study 2 we only selected women (as the study 1 the full sample was women).

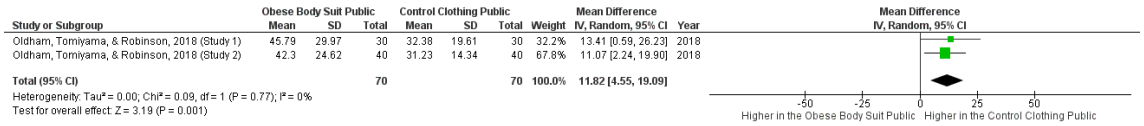

Figure 3 - Forest plot of comparison: Obese Body Suit Public versus Control Clothing Public, outcome: Snack food consumption (g). IV: interval variable; SD: Standard Deviation; CI: Confidence Interval.

The effect size was measured as "Mean Difference" as both studies measured the effect in the same way (technique and scale). For study 1 from Oldham et al., 2018, this value is 13.41 with a wider 95% CI (0.59, 26.23) when compared to study 2, which means that study 1 has less precision. Study 2 from Oldham et al., 2018, has a square size bigger than study 1, which indicates a higher study weight. The pooled effect size is 11.82 & 95% CI 4.55, 19.09, therefore, the overall effect is significant.

No studies are crossing the line of no effect, which means the results are significant. The same can be said about the pooled results since the diamond does not cross the line of

no effect. This is corroborated by the test for overall effect [Z statistic = 3.19 (P = 0.001)], showing that the overall effect is statistically significant (P<0.05).

Regarding the direction of the effect size relative to the line of no effect, favours the *Control Clothing* group compared to the *Obese Body Suit* group. No results favour the *Obese Body Suit* group when it comes to the outcome (*snack food consumption*).

When it comes to the study heterogeneity, the effect sizes do not vary much between studies, since graphically they overlap. So, overall, there is no/low heterogeneity. This is also reflected in the statistical tests for heterogeneity [$Tau^2 = 0.00$; $Chi^2 = 0.09$, df = 1 (P = 0.77); $I^2 = 0\%$] as the P-value is greater than the alfa level of 0.05 and the I^2 statistic is less than 25%.

Secondary outcomes

Comparison 1: Obese Body Suit versus Control Clothing

Data were available for the *Emotional functioning* outcome, more specifically *Stigma* and *Negative Affect*.

Stigma

Two studies (Oldham et al., 2018) delivered this outcome through the means of *Self-Presentation Concerns* measured through the Likert scale (Incollingo Rodriguez, Heldreth, & Tomiyama, 2016). We, therefore, extracted data from the studies as mean and standard deviations.

<u>Meta-analysis findings</u>

To perform the meta-analysis for this outcome, we selected the results from the public & private settings in study 1 since no control values were available independently. In study 2, we used a full sample as no values were reported individually for men and women. Study 1 only studied women.

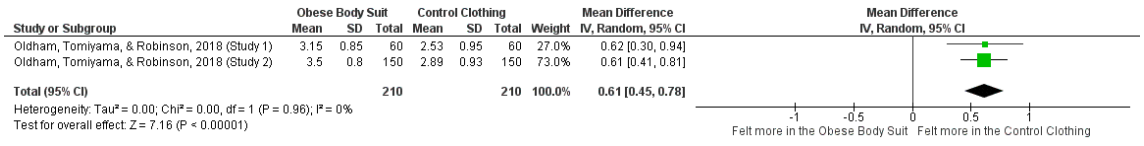

Figure 4 - Forest plot of comparison: Obese Body Suit versus Control Clothing, outcome: Self-presentation concerns. IV: interval variable; SD: Standard Deviation; CI: Confidence Interval.

The effect size was measured as “Mean Difference” as both studies measured the effect in the same way (technique and scale). For study 1 from Oldham et al., 2018, this value is 0.62 with a wider 95% CI (0.30, 0.94) when compared to study 2, which means that study 1 has less precision. Study 2 from Oldham et al., 2018, has a square size bigger than study 1, which indicates a higher study weight. The pooled effect size is 0.61 & 95% CI 0.41, 0.81, therefore, the overall effect is significant.

No studies are crossing the line of no effect, which means the results are significant. The same can be said about the pooled results since the diamond does not cross the line of no effect. This is corroborated by the test for overall effect [Z statistic = 7.16 (P < 0.00001)], showing that the overall effect is statistically significant (P<0.05).

Regarding the direction of the effect size relative to the line of no effect, favours the *Control Clothing* group compared to the *Obese Body Suit* group. No results favour the *Obese Body Suit* group when it comes to the outcome (*snack food consumption*).

When it comes to the study heterogeneity, the effect sizes do not vary significantly between studies, since graphically they overlap. So, overall, there is no/low heterogeneity. This is also reflected in the statistical tests for heterogeneity [$Tau^2 = 0.00$; $Chi^2 = 0.00$, df = 1 (P = 0.96); $I^2 = 0\%$] as the P-value is greater than the alfa level of 0.05 and the I^2 statistic is less than 25%.

Negative Affect

Two studies (Oldham et al., 2018) delivered this outcome. In study 1 (Oldham et al., 2018), *affect* was measured with 6 questions asking participants to rate how happy, sad, stressed, irritated, relaxed and angry they felt on a 100 point visual analogue scale (VAS) with anchors of ‘not at all’ and ‘extremely’. Items relating to negative affect (sad, stressed, irritated and angry) were averaged to provide a negative affect score. In study 2 (Oldham et al., 2018), *affect* was measured through *The Positive and Negative Affect Scale (PANAS)* (D. Watson, Clark, & Tellegen, 1988). We, therefore, extracted data from the studies as mean and standard deviations.

Meta-analysis findings

To perform the meta-analysis for this outcome, we selected the results from the public & private setting in study 1 since no control values were available independently. In study 2, we used a full sample as no values were reported individually for men and women. Study 1 only studied women.

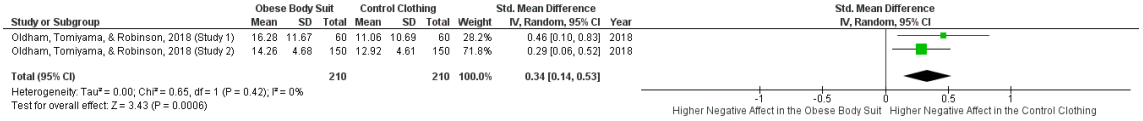

Figure 5 - Forest plot of comparison: Obese Body Suit versus Control Clothing, outcome: Negative Affect. IV: interval variable; SD: Standard Deviation; CI: Confidence Interval.

The effect size was measured as "Standardised Mean Difference" as studies measured the effect in slightly different ways as described above. For study 1 from Oldham et al., 2018, this value is 0.46 with a wider 95% CI (0.10, 0.83) when compared to study 2, which means that study 1 has less precision. Study 2 from Oldham et al., 2018, has a square size bigger than study 1, which indicates a higher study weight. The pooled effect size is 0.34 & 95% CI 0.14, 0.52, therefore, the overall effect is significant.

No studies are crossing the line of no effect, which means the results are significant. The same can be said about the pooled results since the diamond does not cross the line of no effect. This is corroborated by the test for overall effect [Z statistic = 3.43 (P = 0.0006)], showing that the overall effect is statistically significant (P<0.05).

Regarding the direction of the effect size relative to the line of no effect, favours the *Control Clothing* group (which means higher negative affect in this group) compared to the *Obese Body Suit* group. No results favour the *Obese Body Suit* group when it comes to the outcome (*negative affect*).

When it comes to the study heterogeneity, the effect sizes do not vary much between studies, since graphically they overlap. So, overall, there is no/low heterogeneity. This is also reflected in the statistical tests for heterogeneity [$Tau^2 = 0.00$; $Chi^2 = 0.65$, df = 1 (P = 0.42); $I^2 = 0\%$] as the P-value is greater than the alfa level of 0.05 and the I^2 statistic is less than 25%.

DISCUSSION

Summary of main results

From the interventional studies, we identified 2 RCTs evaluating the psychosocial experience of feeling overweight; 2 RCTs evaluating the effect of anti-obesity reading; 1 RTC evaluating the biomechanical characteristics of gait pattern while walking and running at different speeds; 1 SCS evaluating the metabolic rate in non-exercise activity wearing unstable; 1 SMI evaluating confidence in management tasks and their confidence and experience in communication tasks after social media training.

From observational studies, 7 CS studies associated outcomes with the exposure of AOO with social media. Among these, two studies offered an association to magazine reading exposure and one of them with fashion magazines; two studies found an association with perceived media pressure on body image; one supporting study offered an association with appearance-related social media use; 1 study was associated with clothing size; 1 CS supporting study associated with morphology changes and shoe design. From 2 CohS, one of them reported an association with social media exposure while evaluating foreign social media, and another, a relation with clothing size, especially oversized style. All QS studies (N= 3 studies) were associated with fitting into different clothes; one of them reported associations with the clothing shopping experience. We identified four studies applying mixed methods research associating more than one aspect related to fashion. Among it, 2 studies were associated with social media exposure, both regarding the perceived media pressure on body image; two studies mentioned the general influence of clothing; one of the studies was associated with woman's hairstyle; one study was also associated with fitting into different clothes.

Adolescents' health-related quality of life – Instruments of Assessment

Based on the results of our review, we found two instruments of assessment for adolescent's health-related quality of life: the KIDSCREEN questionnaire and the scaling and scoring of the pediatric quality of life Inventory ™ (PedsQL™) (Freira et al., 2019; Sundar et al., 2020; Varni, 2021). For one of these instruments of assessment (*KIDSCREEN-52, Health Questionnaire for Children and Young People, Child and*

Adolescent Version), we identified a single study (Sundar et al., 2020), with a moderate risk of bias, which measured and explored the HRQoL among adolescents with overweight or obesity while using *KIDSCREEN-52* questionnaire. The authors compared their results from the application of the *KIDSCREEN-52* questionnaire to data from a larger Norwegian HRQoL validation study, selecting the same age group of their study. A parameter evaluated through the *KIDSCREEN-52* questionnaire concerns how they feel about their clothing and accessories, which is included in the subscale about the *self* (*self-perception*). Although in this supporting study, the results show that most of the interviewees expressed a negative view of their bodies, but not their clothing or accessories, it is stated in the results of the same study that recent research has indicated that adolescents´ body image is influenced, among other things, by beauty – which is included in the definition of fashion proposed by Susan B. Kaiser (Kaiser, 2019). Also, in this study using the *KIDSCREEN-52* questionnaire (Sundar et al., 2020), the authors conclude that AOO are vulnerable, specifically to their physical well-being, but also to their *self-perception*; plus, responses regarding self-perception may have provided better results on HRQoL because of how the questions were formulated, integrating clothes and accessories, as well as looks. Furthermore, their results confirm the importance of developing and testing interventions, using methods that promote resilience and that do not result in adolescents feeling more stress or weight-related stigma.

Other supporting studies (D. C. S. James et al., 2012; Martínez-Aguilar et al., 2010; Wills et al., 2006), with moderate risk of bias, included in the results of our systematic review support the finding of the study exploring the *KIDSCREEN-52* questionnaire (Sundar et al., 2020) and give strength to the importance of clothing in AOO. Among these supporting studies, two studies have found that AOO felt restricted in what clothes they were able to buy and wear (D. C. S. James et al., 2012; Martínez-Aguilar et al., 2010; Wills et al., 2006) and appointed difficulties to find clothes that make them see themselves positively (Martínez-Aguilar et al., 2010). These descriptions would be relevant when applying the *KIDSCREEN-52* questionnaire (Sundar et al., 2020), specifically in the subscale “About Yourself” (self-perception). Additionally, another critical question when assessing these questionnaires is the variability of appearance-

related valorisation given by the adolescent. That can be ethnic-dependent as shown in one of these supporting studies (D. C. S. James et al., 2012): for African Americans, appearance and clothing could influence the results when applying, for example, the *KIDSCREEN-52* questionnaire (Sundar et al., 2020).

One study (Heidelberger & Smith, 2018) (moderate risk of bias), in the results of our review, reported that AOO (mean age 10.4 years/African American and American Indian) prefer that the images on a body image assessment tool have detailed facial features and are clothed (for example in the case of the *Figure Rating Scale (FRS) instrument*).

Behaviour Change/overcome challenges/treatment compliance

Behaviour change resulted from social media, namely magazine reading (Latner et al., 2007) and social media pressure (Felicitas et al., 2015), both with moderate risk of bias. In the first study (Latner et al., 2007), a greater dislike of obese boys and girls relative to their non-overweight peers (age range from 10 to 13 years old) was uniquely predicted by magazine reading time (other associations analysed in the study: television and videogame exposure). This may be especially true for those with high internalization of the thin ideal, who may be more vulnerable to the negative effects of magazine images. Regarding the behaviour change associated with social media pressure (Felicitas et al., 2015), it was reported that Chinese adolescents (among middle and high school girls) with greater exposure to foreign media significantly decrease their BMI over time. The study further showed that the media served as a significant predictor for both girls and boys to engage in behaviours to lose or gain weight as well as to increase muscle bulk.

When it comes to the outcome *overcome challenges/treatment compliance*, other supporting studies reported fashion-related associations with AOO that can implications for practice, and so, it will be discussed in that section (Bodiba, 2008; D. C. S. James et al., 2012; Martínez-Aguilar et al., 2010; Wills et al., 2006).

Changing nutrition choices/eating-related behaviours

Based on our results, the studies (Oldham et al., 2018) related to the **psychosocial experience of feeling overweight**, while wearing an obese body suit in public to evaluate

snack food consumption in both women and men, did not prove an increase in food consumption by the experimental group when compared with the control group. Our meta-analysis shows a greater consumption in the control clothing group than in the experimental group (Figure 3). Also, both studies are classified by risk of bias as "some concerns". However, they reported in their publication that women in the experimental group consumed more food, but not men; none of the proposed mediators that were affected by the clothing condition (body anxiety, self-esteem, self-presentation concerns, explicit perception of overweight, effortful self-control and negative affect) was associated with food consumption (Oldham et al., 2018).

Social media exposure, specifically perceived media exposure on body image is reported to modulate **eating-related behaviours** in the results of our systematic review (Heidelberger & Smith, 2018). They show in their study that children (Age: M = 10.4) who were exposed to infomercials, learned how to lose weight from it and determined "the right size you should be is medium", which influenced their body image and experienced negative consequences related to it (as *eating disorder*). Another type of media exposure we found to suppress food intake by heavier women (age range 17 - 57 years old, M = 20.35 ± 4.70 years old) was reading about the negative effects of obesity (exposure to media-portrayed anti-obesity messages) (Shentow-Bewsh et al., 2016). This study was classified as low risk of bias.

Symptoms of depression

Subclinical symptoms of depression were associated with social media exposure among obese adolescents (aged 14-18 years). As so, they (Goldfield et al., 2016) concluded that screen time (spent watching television, playing seated/inactive video games) and using the computer for recreational reasons (excluding school work)) may represent a risk factor or marker of depressive symptomatology in obese adolescents. The depressive symptomatology was assessed through the *Children's Depression Inventory (CDI)* (M, 1992). Another supporting study (Jeffers et al., 2013) found a significant correlation between social media pressure with depressive symptoms: there was a statistically significant indirect effect of BMI on depressive symptoms mediated by media pressure on body image. To measure the depressive symptoms in this study, it was applied the

Center of Epidemiologic Studies Depression Scale-Revised (CESD-R) (Van Dam & Earleywine, 2011). It is important to mention that both supporting studies reported in our results were classified with a high risk of bias.

Body Mass

Based on our results, we found fashion-related associations with body mass reported as a measured change in BMI: *social media exposure*, *large clothing size*, *oversized clothing*. Regarding *social media exposure,* there were two studies (Felicitas et al., 2015; Jeffers et al., 2013) reported a significant association with media pressure, while one study (Bennett et al., 2020), which is more recent, reported that BMI was not significantly associated with fear of fat, weight bias, or media use. These differences in the results of these studies might be explained by the growth of plus-size models during the last years. However, no studies are proving this. The changes in BMI associated with exposure to social media were related to a significant decrease in BMI over time among middle and high school Chinese girls with greater exposure to foreign media, especially girls who placed greater importance on appearance (Felicitas et al., 2015); and BMI levels were associated with greater depressive symptoms when there were higher reports of felt media pressure on body image (Jeffers et al., 2013).

Large clothing size (CSz) in children (age range from 6 to 18 years old) is associated with high BMI (overweight and obesity) and clustering of medical comorbidities such as habitual snoring, obstructive sleep apnea, bronchial asthma, and elevated blood pressure. CSz greater than +2 size was associated with at least 2 times increased odds for the presence of 1 or more of these obesity-related health risks (Nafiu & Burke, 2013). Another study, in our results, which supports this association is Trovato et al., 2016. In this study, they found an association between the oversized clothing fashion trend and the enhancement of obesity in non-alcoholic fatty liver disease (age range from 15 to 35 years old).

Physical Activity, Physical Exercise and Physical Performance

Our included studies (Jiménez-Ormeño et al., 2013; Rubinstein et al., 2017) reported relevant *changes in biomechanical characteristics* during the development of

adolescents with overweight and obesity. The biomechanical characteristics that vary between AOO and normal-weight group during variable walking and running speeds are elongation of cycle length, increased cycle time, and a longer relative double-support phase; along with increased peak pressure and increased maximum force. As these gait parameter differences may lead to foot pain and predispose overweight/obese children to overuse injuries, the characterization of activity patterns of AOO should be carried out before they join an exercise training programme and increase their physical activity to maintain or reduce body weight (Rubinstein et al., 2017). For other reasons, the results of this RCT might be justified by the morphological differences between AOO and the normal-weight group reported in the supporting study Jiménez-Ormeño et al., 2013. They found significant differences between the morphology of the feet of children (age range from 6 to 12 years old) with normal-weight and overweight and among children with normal-weight and obese for all variables (foot length, ball width, ball height, distance to 1^{st} metatarsal, distance to 5^{th} metatarsal, heel width, forefoot width, instep height, arch height). Differences in width, ball height, and arch height were only found among overweight and obese children. There were no changes in the foot morphology of children between 10 and 12 years. Obese children showed more gradual changes in their foot measurements. The average percentage increase by year in children with normal weight and obesity were similar; however, morphological measurements of the foot of overweight children increased at a faster rate. These studies were classified with a moderate risk of bias.

Changes in metabolic rate were reported by Maffiuletti et al., 2012, where was found that ergonomic footwear with an unstable rounded sole increases energy expenditure of obese patients during non-exercise activity (standing or walking) as the result of increased muscular involvement. In this study, the shoes were well tolerated, and no adverse effects were noted. However, these shoes were significantly heavier than conventional shoes; shoe sizes and gait parameters did not differ between the two experimental conditions. During quiet standing, relative oxygen uptake and metabolic rate were significantly higher with unstable shoes compared with conventional shoes; respiratory exchange ratio was significantly lower while wearing unstable shoes, whereas heart rate and minute ventilation did not differ between the 2 conditions;

during walking at the preferred speed, gross and net oxygen uptake, minute ventilation, gross and net metabolic rate, and gross and net energy cost were significantly higher with unstable shoes compared with conventional shoes. Heart rate and respiratory exchange ratio did not differ between the 2 conditions; the metabolic rate was independent of BMI as no significant correlations were observed for both conditions.

Martínez-Aguilar et al., 2010 reported that AOO mentioned going jogging as an action to improve their physical appearance (as look good in their trousers). Therefore, this description fits perfectly one of the outcomes of this systematic review: *willingness to perform physical activity*. This study was classified with a moderate risk of bias.

Regarding the role of hairstyle choices in physical activity, it was reported (Woolford et al., 2016) a preference for long, straight hairstyles – among African American adolescent (AAA) girls – which are impacted adversely by sweating. In addition, hairstyle choice (extensions versus no extensions) appears to be associated with levels of physical activity for the respondents overall and ethnic identity appears to be associated with levels of physical activity for some participants. This study was classified with a moderate risk of bias.

Emotional Functioning

Positive (happy and relaxed) *and negative* affect (sad, stressed, irritated and angry) were measured, as described in the results, in two experimental studies (Oldham et al., 2018) which had the aim to explore the psychosocial experience of feeling overweight while wearing an obese body suit and compare to a control group (described in the results). Changes in *positive affect* were reported to be significant between clothing condition and time point: participants who wore the obese body suit (M = 47.26, SD = 18.17) exhibited significantly less positive affect than control participants (M = 58.77, SD = 20.14) post-task. For this outcome, we were not able to perform a meta-analysis as we did not find other suitable studies for inclusion. In the case of *negative affect*, they reported, as well, a significant interaction between clothing condition and time point: participants who wore the obese body suit (M = 47.26, SD = 18.17) exhibited significantly less *positive affect* than control participants (M = 58.77, SD = 20.14) *post-task*. However, when performing meta-analyses, we found that the results favour the *Control Clothing*

group (which means higher *negative affect* in this group) compared to the *Obese Body Suit* group. This might be explained by the possible bias of participants being aware of the aim of the studies. Furthermore, to perform the meta-analysis, there were some variations between samples in both studies: study 1 and 2 (Oldham et al., 2018) the results of *affect* were reported in general; the sample of study 1 for meta-analysis included results from public and private setting, just for female; the sample of study 2 for meta-analysis included results from male plus female, just in a public setting. However, the authors (Oldham et al., 2018) reported that the interaction between time point and gender and time point, gender and clothing condition was not significant for *negative affect* scores. Also, the interaction between setting and time point and time point, setting and clothing condition were not significant (Oldham et al., 2018).

In all studies (Bodiba, 2008; Shentow-Bewsh et al., 2016) that reported *self-esteem* as an outcome, it was found that social media was a mediator. An experimental study with a low risk of bias (Shentow-Bewsh et al., 2016), found that participants **who perceived greater pressure to be thin** did interact with condition (**reading the anti-obesity article**) in predicting changes in both *body esteem* and *weight-related body esteem*. This relation was not present in the control groups. However, this effect depends on the form in which the article is written and depends as well on the individual's ability to cope with feelings resulting from the reading of anti-obesity messages. The supporting study (Bodiba, 2008) reports the same outcome – *self-esteem* – where low *self-esteem* was perceived to be aggravated by several factors, like the attitude of the media and society.

Body image related experiences (both positive and negative) were documented - in the results of our systematic review – to be influenced by ***fashion-related mediators*** mainly *appearance-focused media* (Bennett et al., 2020; Bodiba, 2008; Felicitas et al., 2015; Goldfield et al., 2016; Heidelberger & Smith, 2018; Shentow-Bewsh et al., 2016; Wyssen et al., 2016), where it is included time spent *reading fashion magazines* (Felicitas et al., 2015). Additionally, another mediator was mentioned in the included studies: wearing the obese body suit (the *psychological experience of feeling overweight*) (Oldham et al., 2018). This last report (Oldham et al., 2018), contained two studies: study 1, evaluating *body satisfaction*; study 2, evaluating *body dissatisfaction*. In study 1 by Oldham et al., 2018, where authors measured trait body satisfaction (TBS) (Dewey, Newton, Brodie, &

Kiemle, 1990), they reported, in the supplementary data, that the overall model with body satisfaction as the moderator was significant, meaning that TBS was negatively affected directly (Oldham et al., 2018). Concerning study 2 from Oldham et al., 2018, the authors examined contributing factors for *body dissatisfaction* (Paterna, Alcaraz-Ibáñez, Fuller-Tyszkiewicz, & Sicilia, 2021): *body anxiety* and state *self-esteem*. *Body anxiety* was evaluated by the Physical Appearance State Anxiety Scale (Reed, Thompson, Brannick, & Sacco, 1991), and they found that body anxiety scores were gender dependent (women had higher body anxiety than men). Plus, it was documented that clothing also had a significant effect on *body anxiety*, whereby participants who wore obese body suits felt more anxious about their bodies than controls (gender independent) (Oldham et al., 2018). Regarding *self-esteem*, it was measured by the appearance subscale of the state Self Esteem Scale (Heatherton & Polivy, 1991). The authors found the following: women had lower *self-esteem* than men; clothing had a significant effect on *self-esteem*, whereby participants who wore the obese body suit reported having lower *self-esteem* than those who wore the control clothing. In a supporting study, included in the results of our review, (Sundar et al., 2020) was evaluated signs of *body dissatisfaction*. There was reported that most of the interviewees expressed a negative view of their bodies, but not their clothing or accessories, as one girl said (Sundar et al., 2020):

> "I'm sort of satisfied with myself, but not with my body. I want to change my looks and lose weight. But I think my personality is ok."

When it comes to *appearance-focused media*, across the previously mentioned studies, it was found to influence the *body image* through beliefs related to self-worth and how AOO see themselves. For example, it seems the way media emphasizes weight loss has affected how AOO feel about themselves: feeling pressure on how they look, including fear of fat, which was reported to be positively related to weight bias; not feeling accepted, valued or loved by peers. And so, this contributes to the development of dysfunctional beliefs about appearance and body image perception, and consequence, *body dissatisfaction*. Shentow-Bewsh et al., 2016 (a study with a low risk of bias), reported that reading anti-obesity messages may further increase their concerns about

their weight. Another study stating a sign – *body avoidance* – of *body dissatisfaction*, documented that AOO had fear of trying on clothes in front of other thinner peers (Wills et al., 2006). *Aspirational social comparison* (other sign of *body dissatisfaction*) was found to be mediated by *appearance-focused media*, as youth tend to compare themselves to idealized but unattainable images (Goldfield et al., 2016). However, this supporting study was classified as having a high risk of bias. Another supporting study (Wyssen et al., 2016) revealed that the vivid imagination of thin ideals is accompanied by a decrease in *mood* and *body satisfaction* and triggers body-related cognitive distortions in females. Regarding the decrease in mood and *body satisfaction,* the results showed that imagination of thin ideals, rather than mere exposure to a *fashion magazine*, has a negative impact. **Among these studies, one documented positive experience related to appearance** (D. C. S. James et al., 2012)**, and reported that physical appearance improvement was a motivator to lose weight in AOO:**

> "I want to get back into short shorts. I am tired of having to worry about a whole new wardrobe; It affects my self-image, you know. I want to feel like I look good to myself, nobody else."

We were able to find that *fitting into different clothes* influences *emotional functioning* in different types of studies classified with moderate to high risk of bias. There was evidence (Martínez-Aguilar et al., 2010; Wills et al., 2006), with moderate risk of bias, that AOO were limited in what clothes they were able to buy and wear, special when it comes to fashionable clothes and popular designer labels. AOO believe that these clothes are made for the thinner than overweight people are. The participants appointed that they have difficulties finding clothes that make them see themselves positively. Thus, they worry that people criticize and make fun of them if they wear these clothes, which makes them feel bad about themselves, and even, "feel depressed". Another supporting study (Bodiba, 2008), with a high risk of bias, states similar feelings influenced this *fashion-related mediator*. An interventional study (Oldham et al., 2018), with a moderate risk of bias, while evaluating the psychological experience of feeling overweight while participants wearing an obese body suit, reported that clothing condition did not affect self-presentation concerns. However, taking into account the limitations of this interventional study (as the procedure was implemented) and having

in mind that the clothing condition (obese body suit) was a body prosthetic designed to make them appear obese with standard clothing over the top, we cannot establish a relationship with the other supporting studies mentioned in the subject *fitting into different clothes*.

Social Functioning

Social limitations were found to be influenced by *fashion-related mediators* in our included supporting studies (Bodiba, 2008; D. C. S. James et al., 2012; Martínez-Aguilar et al., 2010). Although studies have some issues when it comes to bias (such as the type of study design or having blinding issues), both were consistent with the documented results: participants appointed to face limitations in terms of finding clothing to wear, especially in the fashionable clothing and designer brands segment. Some examples of what participants reported in the study are:

> "Clothes do not fit well with my weight, some item does look well, but others don't, most of the times clothes do not fit well with my weight." (Martínez-Aguilar et al., 2010); "…clothes, they don't fit me with this type of body, it bothers me because, as I'm fat, I can't find clothes very easily like any other person" (Martínez-Aguilar et al., 2010); "if you are overweight and try wearing these clothes people will make fun of you or criticize you, which make one feel bad about themselves" (Bodiba, 2008); "You can't buy the really nice clothes" (D. C. S. James et al., 2012); "You're limited to stretch pants that show your dimples" (D. C. S. James et al., 2012).

These studies did not include Caucasian ethnicity.

There was evidence from supporting studies, with moderate risk of bias, included in our review that the following *fashion-related mediators* might influence *stigma*: time spent reading fashion magazines; a sense of style; trying clothes in front of other thinner peers/self-presentation concerns. Time reading fashion magazines (Latner et al., 2007) was associated with greater dislike of obese children relative to their non-overweight

peers, and even, with prejudiced and discriminatory attitudes held toward other people based on standards of weight (*antifat attitudes*) (Lin & Reid, 2009). This can lead to different types of stigma: *experienced stigma*, *internalized stigma*, *perceived stigma*, and *stigma endorsement*. This *internalized stigma* was found to be present, also, in AOO while trying clothes in front of other thinner peers, which restricted shopping trips with friends (Wills et al., 2006). Therefore, has an important impact on the lifestyle of this population. Study 2 by Oldham et al., 2018 reported also self-presentation concerns among participants who wore the obese body suit than controls. However, when performing meta-analyses, we found that participants felt more concerns while wearing the control clothing (Figure 4). When it comes to the influence of a sense of style, it was found to be one of the most important qualities when choosing a friend, alongside other qualities such as personality (being nice and helpful), and *what's on the inside is most important* (Heidelberger & Smith, 2018). This might promote *stigma endorsement*.

The appearance was reported to influence *social functioning* (in a supporting study with moderate risk of bias) and has implications for money (D. C. S. James et al., 2012):

> "All of my clothes are tight. I spend so much money on clothes and then they are too tight. I hate to see how I look in the mirror. The only thing I can see is gut and more gut."

With a high risk of bias, one study (Llauradó et al., 2021), documented that peer leader training through social marketing intervention improved confidence and interest in different tasks, including oral presentations, social media use and collaboration with people. Although there is no reported the IMC of participants, this shows a positive impact on the social functioning of these adolescents.

School Functioning

The study by Llauradó et al., 2021, was school-based and showed improved confidence in managing different tasks and communication skills, which might contribute to fewer problems at school.

Overall completeness and applicability of evidence

Our population group of interest - adolescents with obesity or overweight - is a very specific yet substantial and globally increasing subgroup of the general population. Of the 23 included studies, the study population of only ten studies included exclusively adolescents and only 3 studies (Goldfield et al., 2016; Martínez-Aguilar et al., 2010; Sundar et al., 2020) included exclusively AOO. Most of the identified studies aimed to understand factors/mediators that influence obesity or overweight and the perception of adolescents with obesity or overweight about their condition. In the case of studies in which authors did not stratify the results per BMI or percentile, despite our efforts to obtain them, the subgroup data for some studies have not been available to date. Overall, the results of this review suggest the applicability of the findings for paediatric, child and adolescent psychiatry or general practice for some but not all assessed outcomes (see Implications for practice).

Potential biases in the review process

We officially searched 3 electronic databases. We also contacted authors to obtain unpublished data and we were not able to obtain unpublished outcome data from none.

Nevertheless, we intended to review evidence in a specific subgroup of adolescents; the following limitation should therefore be considered. Most data published and included in our systematic review were not specified by BMI, ethnicity or age group. This might lead to misleading conclusions as younger adolescents might have different interests, views, and cognition from older adolescents, and those from children and adults. Also, although we included a great variety of ethnicities, where fashion-related mediators have consistently reported cross ethnicities (as the influence of appearance-focused media/fashion magazines, as well as, physical appearance and looking good on clothes as motivation to lose weight), some of our results might vary between ethnicities (which is the case of the influence of hairstyle in physical activity, as this was only studied in AAA, and might be cultural dependent).

Included studies evaluating an intervention were only 7, although only one was classified with a high risk of bias, which can influence the strength of our systematic review.

However, to our knowledge, it is the first systematic review evaluating fashion-related mediators influencing obesity.

Other possible factors which can contribute to biases are the fact that more time would be needed to further explore the details of some outcomes, and the fact of the main author of the systematic review – the student – presently works with social media in the field of the subject of the thesis.

Agreements and disagreements with other studies or reviews

Fashion, apparel or call it clothing, what we wear is a powerful aspect of human experience, which goes beyond what our clothes say about us or others (Adam & Galinsky, 2012; Carolyn Mair, 2018). Nobel Prize-winning author Isaac Bashevis Singer asserts (Adam & Galinsky, 2012):

"What a strange power there is in clothing."

In the last 20 years, fashion-related research has grown exponentially, expanding even to the application of psychology to fashion, including the creation of undergraduate and postgraduate degrees in applied psychology in fashion, which is accredited by the British Psychological Society (University Arts London, 2022). However, to our knowledge, no studies have been conducted to understand fashion-related mediators in AOO, while exploring new ways of clinical management of this special population.

To evaluate the influence of fashion-related mediators in the clinical management of AOO, we analysed how parameters from the *Pediatric Quality of Life Inventory*™ (PedsQL™) (Varni, 2021) – including other aspects related to it – could be influenced by fashion-related mediators.

When evaluating how ***instruments of assessment*** (paediatric health-related quality of life) would be influenced by fashion-related mediators, we found that there is applicability as assessing HRQoL through questionnaires is a subjective task, involving cognitive processes (Sundar et al., 2020). Clothes are said to systematic influence the wearer's psychological processes (Adam & Galinsky, 2012). Therefore, as seen in our

results, it may influence the results of instruments of assessment. For example, when applying figure rating scale (FRS) instruments, AOO reported preferring that the images on a body image assessment tool have detailed facial features and are clothed. This makes them relate more to the image and give more accurate answers as children and young adolescents may not be able to compare themselves to an image as easily as adults (Heidelberger & Smith, 2018). Furthermore, in instruments such as KIDSCREEN-52, the scores were lowest in the subscales of physical well-being, self-perception, social acceptance and bullying (Ottova et al., 2012). Thus, as reported in the results of our systematic review, fashion-related mediators might influence these important subscales. It is highly important to mention that in the subscale of self-perception, they state clearly the relevance of specific fashion-related mediators and describe self-perception as (Ravens-Sieberer et al., 2005; Sundar et al., 2020):

> "*Positive or negative bodily appearance, through questions about satisfaction with looks, clothes and accessories".*

Other studies (Martínez-Aguilar et al., 2010; Wills et al., 2006) supported the influence of the fashion-related mediators in self-perception and that will be discussed more appropriately under the emotional functioning outcome – fitting into different clothes – later in the review (see page 60-61).

In the case of fashion-related mediators which might influence ***behaviour change***, as seen in the previous sections of the systematic review – magazine reading (Latner et al., 2007) and pressure perceived by social media (Felicitas et al., 2015) – some studies support our results. There is a systematic review with meta-analysis available on the effect of experimental presentation of thin media images on body satisfaction (Blaivas, Levine, & Murnen, 2002), where is documented the following:

> *"Body image was significantly more negative after viewing thin media images than after viewing images of either average size models, plus-size models, or inanimate objects. This effect was stronger for between-subjects designs, participants less than 19 years of age, and for participants who are vulnerable to activation of a thinness schema."*

Furthermore, Wyssen et al. 2016, reported that repeated exposure to thin ideals as it happens in daily life together with susceptibility to body-related cognitive distortions may be relevant factors in predicting long-term negative effects. A recent study (Binder, Noetzel, Spielvogel, & Matthes, 2021) showed that the social media context, in comparison to a magazine context, can negatively impact the positive mood and body satisfaction of the consumers. The authors argue that participants in the social media condition compared themselves to the fictive Instagram bloggers to a greater extent in terms of both, health- and appearance-framed content. This is following the study included in our results, where it is reported that those after vivid imagination, but not after mere fashion magazine exposure, had higher negative effects of magazine images (Wyssen et al., 2016). Therefore, we might say that the influence of fashion-related mediators is dependent on the degree of the internalization of the thin ideal. As result, the finding that there is a greater dislike of obese boys and girls relative to their non-overweight peers – more negative reactions to obese girls and boys (Latner et al., 2007) – depends mainly (based on the results available so far) on the vulnerability to relate to what is shown in the media content, being especially true in the case of social media content. We also argue that magazines, during the last couple of years, portray a greater variety of body types and ethnicities as they have been pressured to do so by community/society and the rise of advocates in this field (McClendon, 2019; Peters, 2017). In contrast, Instagram bloggers are freer regarding the content they published and ware that appearance-focused content is more appellative to the audience. Actually, in a study (Pedroni, 2022) it is said the following:

> "Why were fashion bloggers successful? Because if you look at a magazine and at a model wearing a dress […] you always have the doubt that that thing doesn't fit you … and so, this creates that huge distance between you and the model, between you and the brand. The blogger, who on the other hand is a real person, an ordinary person, […] is the real person who wears that garment and who shortens the distance between you and that garment: if she put it on, it can fit me too."

In our results, another included study (Felicitas et al., 2015) reported that greater exposure to foreign media leads to a significant decrease in BMI over time in Chinese adolescents (who are shown to have alarming research results documenting body dissatisfaction and eating disorder symptoms), which infantizes the influence of social media to engage in behaviours to manage weight, including increase muscle bulk (Jackson & Chen, 2014).

Several studies are available on ***eating-related behaviours and changing nutrition choices*** upon exposition to appearance-related media, leading to actions towards achieving "the right size" (Heidelberger & Smith, 2018). Besides that, exposure to messages about the dangers of obesity may be also found to lead to changes in eating habits, while restricting food intake in many (Greener, Douglas, & van Teijlingen, 2010; Shentow-Bewsh et al., 2016). This agrees with another systematic review (Binder et al., 2021), where results revealed that exposure to appearance-focused framing led to a lower positive mood compared with exposure to health-focused framing in overweight and obese participants, which emphasizes the importance of the message behind the image, and that in certain AOO there is important to acknowledge appearance (during the motivational interview in a consultation) allied to health-promoting behaviours (Lemal & Van den Bulck, 2010). They also reported that exposure to a weight-related emotionally salient and personal story leads participants to feel motivated to decrease their food intake, rather than feel stigmatized. As a result, it seems important to incentivise and work with content creators on social media and bloggers to better adequate their messages and image when talking about food, appearance or other fashion-related mediators to achieve better outcomes in obesity management in adolescents (Pedroni, 2022).

A systematic review was conducted reporting on social media's role in adolescents' food choices (Kucharczuk, Oliver, & Dowdell, 2022). The authors found that food and beverage companies aim to target the adolescent population by using social media for marketing their "unhealthy" products through the use of celebrities and influencers. Therefore, AOO would benefit from screenings done routinely for social media use and current eating habits by healthcare professionals, plus being educated about the health

risk. Also, this education should reach parents and families. Furthermore, the American Academy of Pediatrics (AAP) recommends:

> *"Pediatricians need to become educated about the public health risks of media. Given the impact that media have on the health of children and adolescents, AAP chapters and districts, as well as medical schools and residency training programs, should ensure that ongoing education in this area is a high priority."*

The population of our study – AOO –should be also screened for ED pathology, as the cognitive processing of daily thin-ideal exposure (such as imagining) could represent another potential key to the risk of ED. This is even more important, as cognitive distortions are known to be related to emotional and behavioural consequences (e.g., in anxiety or depressive disorders (BECK, 1963; Wyssen et al., 2016)**.**

Another complex correlation is the influence of fashion-related mediators – such as social media pressure – on *depressive symptoms* (Jeffers et al., 2013). Was found a model in the studies included in our results that describes that BMI is related to *depressive symptoms*, but it is mediated by the influence of perceived media pressure on *body image* (Jeffers et al., 2013):

> "Young adults who had higher BMIs also had greater depressive symptoms only when they exhibited higher feelings of pressure from the media to look a certain way."

Other studies agree with this relationship, showing that severe obesity, weight concern, dietary restraint and *body image* concerns may increase the risk of developing *depressive symptoms* in overweight individuals (Chaiton et al., 2009; Ting, Huang, Tu, & Chien, 2012).

The studies included in our systematic review did not evaluate ***patient-reported adverse events***, however, taking into account the social media influence on emotions, body image and behaviours, we might argue that it probably present adverse events and induce ED when managing AOO. And this should be screened as discussed above

(Wyssen et al., 2016; Strasburger et al., 2010; Kucharczuk et al., 2022; Binder et al., 2021).

Nafiu & Burke, 2013, provided insight into CSz as a screening tool for high BMI and clustering of obesity-related comorbidities. This approach was not a new finding as it was previously studied and associated with cardiovascular events, malignancies, hypertension, diabetes and metabolic syndrome (Battram, Beynon, & He, 2011; Han, Gates, Truscott, & Lean, 2005; Hughes, Schouten, Goldbohm, van den Brandt, & Weijenberg, 2009; Morris, Heady, & Raffle, 1956) Also, in another study (Trovato et al., 2016), the oversized clothing fashion trend was associated with enhancement of obesity. Also, it is reported that the universal availability of comfortable and wide clothing may contribute to the enhancement of obesity in overweight, obese, thin and normal-weight subjects (Hsieh, Muto, Murase, Tsuji, & Arase, 2011; Wills et al., 2006).

Regarding the influence of fashion-related mediators in ***physical activity***, there are several outcomes reported that could contribute to improving sports performance (as force and velocity enhancement of motor output)(Elliot, 2015; Elliot & Aarts, 2011; Raccuglia, Sales, Heyde, Havenith, & Hodder, 2018), willingness to perform physical activity and improve comfort during physical exercise. However, for the population in our study, some of the fashion-related mediators have still to be studied.

One of the challenges is adequate sports footwear to the biomechanical characteristics of AOO to promote the best conditions to enjoy and perform the best way workout while preventing injuries (Jiménez-Ormeño et al., 2013; Rubinstein et al., 2017). The benefits of footwear adapted to overweight and obese adolescents are reported also in some studies, including the prevention of future lower limb problems (Halabchi, Mazaheri, Mirshahi, & Abbasian, 2013; Landorf & Keenan, 2000). Additionally, the potential of adapted shoes to AOO can be optimized to increase energy expenditure as reported in one of the studies (Maffiuletti et al., 2012) included in our systematic review. This is supported by evidence found in other studies (Landry, Nigg, & Tecante, 2010; Nigg, Hintzen, & Ferber, 2006). These studies show that increased energy is justified by the greater anteroposterior and mediolateral postural sway, which in turn may have enhanced the electromyographic activity of thigh, shank, and extrinsic foot muscles.

Although this does not reach the energy imbalance target of 100 kcal/day $^{-1}$, recently suggested to prevent weight gain, it is nevertheless a worthy attempt to prevent a positive energy balance in AOO (Hill, Wyatt, Reed, & Peters, 2003).

In Woolford et al., 2016, we found another complex fashion-related mediator of physical activity - *hairstyle choices*. Hairstyle is found – by social sciences – to play a crucial role in people's personal lives and social status. Usually, straighter and longer hair is viewed as the best quality hair while whereas braided, locked, or natural (afro) hair is less likely to be viewed as acceptable. As a result, female back girls are a subgroup special pro to be dissatisfied and pressured by society to select hairstyles that require hair weaving or some form of the straightening process. This process can be tedious and time-consuming, plus often costly. Taking all together, these subgroups of AOO may opt to avoid exercise and associated sweating, which would countercheck time and financial investments. The results of these studies (Barnes et al., 2007; Hall et al., 2013; Harley, Odoms-Young, Beard, Katz, & Heaney, 2009) are coincident with the results of our included study in the results of our systematic review.

The relation existing between ***emotional functioning*** and *fashion-related mediators* could be found in a variety of included studies in our systematic review. It was reported outcomes as *positive and negative affect*, *self-esteem* and *body image perceptions* might be mediated by appearance-focused media – including, reading fashion magazines and social media – and being able to *fit into different clothes* (Bennett et al., 2020; Bodiba, 2008; Felicitas et al., 2015; Goldfield et al., 2016; Heidelberger & Smith, 2018; D. C. S. James et al., 2012; Lin & Reid, 2009; Martínez-Aguilar et al., 2010; Oldham et al., 2018; Shentow-Bewsh et al., 2016; Sundar et al., 2020; Wills et al., 2006; Wyssen et al., 2016).

Aligned with our included studies, we found reported that the increased negative affect in participants wearing obese body suits (Oldham et al., 2018) could explain the link between the experience of feeling overweight and eating behaviour (Tomiyama, 2014). Self-identifying as overweight or obese is associated with reduced self-acceptance and might increase negative affect. This negative affect can result in increased calorie consumption (Carr & Friedman, 2005; Chua, Touyz, & Hill, 2004; Jansen et al., 2008; Puhl & Heuer, 2009; Roberts & Duong, 2013). This experience of affects (positive and

negative) mediated by an obese body suit (body prosthetic designed to make them appear obese with standard clothing over the top) is also supported by the concept of *Dress as Body Modifications* (transformations of hair, skin, nails, muscular/skeletal system, eyes, teeth and breath) *and Supplements* (enclosures, attachments to body enclosures, attachments to the body and handheld objects), which connects the senses of dress (visual, touch, sound, scent, and taste) to the three selves (public, private, and secret selves) (Eicher, 2020). Although the subject *negative affect* might be also related to *stigma* – another outcome in our review – it was discussed here as the parameter analysed – *negative affect* – is contextualized under the *emotional functioning* section in our review and the official tools as PedsQL™ (Varni, 2021).

The reported interaction between *self-esteem*, *appearance-focused media* and *body image* (Bodiba, 2008; Shentow-Bewsh et al., 2016) is consistent with another study that supports our results – media exposure reinforces individuals' perceptions of the thin ideal and increases *body dissatisfaction* (López-Guimerà, Levine, Sánchez-carracedo, & Fauquet, 2010). *Body dissatisfaction* is also found to negatively affect individuals with obesity, especially women while being correlated with poor *self-esteem, depression* and *disordered eating* (Swiatkowski, 2016; Weinberger, Kersting, Riedel-heller, & Luck-sikorski, 2016). Even though it is documented that social media when compared with fashion magazines have a higher impact on *body image* (Binder et al., 2021), there is a study (Swiatkowski, 2016) that found that *body dissatisfaction* and drive for thinness depends on the level of commitment to the type of media (fashion magazine versus health magazines). As nowadays people relate more to social media content (Binder et al., 2021; Pedroni, 2022), we propose that this might justify why social media led to lower body satisfaction and lower positive mood compared to magazines. In the end, this possible results in poor emotional functioning when applying the PedsQL™ assessment tool (Varni, 2021). Another possible reason that makes AOO prone to be more influenced by appearance-focused social media is that it is more tangible and dynamic (than magazines), where adolescents can be bonded to clothes by the act of sharing (mediator), which can be motivating toward ideals. In fashion, that can mean a connection between fashion, body and personality (Choufan, 2021). Another study evaluating the potential neural substrate mechanisms underlying individual differences

in aesthetic engagement documented that participants reporting higher *aesthetic engagement* (through the Openness to Experience scale), exhibited significantly higher connectivity between the default network and sensory and motor cortices, higher connectivity between the ventral default and salience networks, and decreased connectivity between the cerebellum and somatomotor cortex. Thus, individual differences may reflect the general integration of environmental perception with internal emotional experience, which in turn may facilitate comfort with novelty, self-regulation, and positive adaptation to potentially stressful experiences. In addition, the aesthetics facet is associated with decreased cardiac death risk among patients with cardiac disease, lower systemic inflammation, and healthy eating habits (Williams, Johnson, Curtis, King, & Anderson, 2018). As a result, we propose that education in using social media – and applying *fashion-related approaches* in AOO with higher *aesthetic engagement* – may result in better outcomes when clinical following these patients, although further research is needed to explore this relationship. Besides these facts, education in using social media might be beneficial for adolescents as reported in one of the included studies (Llauradó et al., 2021) in our review. Therefore, we suggest that when well managed by health professionals - as recommended by AAP (Strasburger, 2010) – social media might be used as a motivational factor to lose weight while screening AOO about the media impact on health (adverse events).

Another parameter evaluated under the *emotional functioning* sub-group in the PedsQL^{TM} assessment tool (Varni, 2021) is *feeling afraid or scared*, and in fact, it was reported that AOO had fear of trying on clothes in front of other thinner peers (Wills et al., 2006). This feeling is also documented regarding AOO clothing options to wear (limitations to finding fashionable clothing and clothing in the designer labels) as they worry about people's opinions and bullying by peers (Martínez-Aguilar et al., 2010; Wills et al., 2006). As a result, we argue that *fitting into different clothes* (clothes that make them see themselves positively) would improve emotional and social (as can influence the parameter "other teens tease me") functioning, and in the end, lead to better outcomes in managing obesity/weight lost.

Social functioning related outcomes might be influenced by *fashion-related mediators* as reported in our systematic review (Bodiba, 2008; D. C. S. James et al., 2012; Martínez-

Aguilar et al., 2010) while affecting almost all parameters included in the "How I get along with others" sub-group in the PedsQL™ assessment tool (Varni, 2021) as well as the "Friends", "Free Time", "About Yourself" and "Money Matters" sub-groups in the *KIDSCREEN-52* questionnaire (Ravens-Sieberer et al., 2005).

One of the *fashion-related mediators* which influence social functioning is *finding clothing to wear* (especially fashionable clothing and clothing in the designer brands segment), lacking options in fashioning their self-identity (Bodiba, 2008; D. C. S. James et al., 2012; Martínez-Aguilar et al., 2010). Interestingly, in accordance with the findings in our systematic review, it is documented in a report evaluating different case studies in bodily practice (Peters, 2014):

> *"Amongst consumers and arbiters of fashion, garments designed for fat bodies have traditionally been regarded as less than fashionable. Even now, as more designers seek to create on-trend plus-size fashions, high street plus-size retailers have found it difficult to shed their reputations for designing "fat sacks" and "tents," or garments "designed to cover up and hide the body" (…) This notion is furthered by the guidance offered by plus-size style guides, which offer advice on how to hide, cinch, and slim fat bodies through tactful styling, thereby under- scoring the notion that there is a "right way" and a "wrong way" to outfit a fat body (…)Thus, for consumers who fall into the plus-size category yet also seek fashionable and on-trend garments ripped from the pages of fashion periodicals, shopping and the processes of self-fashioning can prove quite difficult if not impossible".*

Besides this fact limiting the social interactions and lifestyle AOO – contributing to more sedentary lifestyles – as they limit their shopping trips experience with thinner peers/friends (*body avoidance*) (Wills et al., 2006), it induces a negative perception of what they can do those other teens of their age can do. As result, this contributes also to AOO having trouble getting along with other teens or even other teens who do not

want to be their friends. All of these parameters are taken into account when applying assessing tools such as PedsQL™ (Varni, 2021) and *KIDSCREEN-52* (Ravens-Sieberer et al., 2005).

With the growth of *plus-size* clothing trends and *plus-size* models, this might be slightly different, however, there are no studies evaluating this. Furthermore, even a recent study (Barry, 2019) stated limitations:

> *"Despite the efforts of fashion brands to create fashionable plus-size clothes, they continue to offer garments designed to cover up and hide the body (..) and contain those bodies that threaten to break out."*

This type of clothing as described above can be perceived by certain AOO as *body-shaming* perpetuating *self-stigma* and *stigma* in society. Other AOO might be comfortable with oversized clothing as it (Brajato, 2021):

> *"(…) transgresses the sexualized overexposure of the muscular body, locating the body itself in a chaotic scenario made of oversized and heavy garments, layering and ambiguities."*

However, there might be also a sign of *self-stigma*. Indeed, in women of all ages, BMI and *body dissatisfaction* were related to the use of clothing for camouflage purposes and a more negative clothes shopping experience (Tiggemann & Lacey, 2009). Also, a study conducted to examine the types of images that accompany online news stories about obesity and see how people with obesity are portrayed in photography (Heuer, McClure, & Puhl, 2011) reported:

> *"72% of images that depicted an overweight or obese person were portrayed in a negative, stigmatizing manner. Overweight/obese individuals were significantly more likely to have their heads cut out of the photos, to be portrayed showing only their abdomens or lower bodies, and to be shown eating or drinking than were non-overweight individuals. Overweight/obese individuals were significantly less likely to be*

shown fully clothed, wearing professional clothing, or exercising than were non-overweight individuals".

This phenomenon might have important implications for self-perception and public perceptions of AOO and might increase prejudice and discrimination which may lead to problems related to *social functioning* and even *school* – as might miss school because of not feeling well, or even, not being able to pay attention in classes (parameters evaluated by the assessment tools as PedsQL^{TM} (Varni, 2021) and *KIDSCREEN-52* (Ravens-Sieberer et al., 2005).

AUTHOR'S CONCLUSIONS

Implications for practice

This review may contribute to increasing evidence that *fashion-related mediators – body image, appearance-focused media, footwear design, clothing size, ability to fit into different clothes, clothing shopping experience* and *hairstyle* – might play an important role in the clinical and psychosocial management of adolescents with overweight and obesity as it might influence *health-related quality of life* of adolescents with overweight/obesity – an important outcome and public health goal in paediatric obesity management. As a result, *fashion-related mediators* may be taken into account when evaluating these patients, special the AOO susceptible to being influenced by *appearance* (higher *aesthetic engagement*) and at risk of *body dissatisfaction*. Also, AOO might take *fashion* as a motivation for losing weight, and pursuing healthier lifestyles. Therefore, *fashion-related approaches* may be applied not just during the Motivational Interviewing (MI), but also as part of the treatment protocol. It is reported that interventions intended to improve self-efficacy and social functioning in young people can lead to benefits for obese adolescents (Fonseca et al., 2014). Plus, recommendations (Barlow, 2007) on AOO say that patient-centered counselling techniques should be applied – as MI – and recognize the importance of social and environmental change to reduce the obesity epidemic, as well as, the importance of identifying new ways for healthcare providers and health care systems be part of broader efforts. Taking all, we

propose that *fashion-related approaches* may be included in the treatment and management of AOO in the following areas of assessment and intervention:

1. In assessment tools, *fashion-related approaches* might be applied as the following:
    a. Image-based scales – such as *Figure Rating Scale* – may use detailed facial features and clothed body images, especially in African American and American Indian younger adolescents;
    b. Screen for aesthetic engagement, for example through the *Aesthetic Interests* subcluster of the *Openness to Experience* scale (NEO-Five Factor Inventory) (Chapman, 2007);
2. In Motivational Interviewing, *fashion-related approaches* might be applied as the following:
    a. Screen for motivation to lose weight related to *fashion mediators* (*fitting into different clothes*, *looking good in sportswear or other clothes that make them see themselves positively*, *saving money on clothes*, *appearance* and others), while acknowledging that it is okay to be motivated by fashion;
    b. Screen for *self-stigma* and *stigma* related to fashion;
    c. Screen about wearing oversized clothing and the reason;
    d. Screen about time spent on *hairstyle* and its influence on exercising and explore insights with AOO about how to overcome limitations in adherence to physical exercise related to hairstyle;
    e. Screen for *appearance-focused social media* use and education about good practices in social media that might contribute to better treatment outcomes. It might be important that medical professionals understand that not only the framing but also the context, might have effects on body-related outcomes;
    f. Screen for daily *thin-ideal exposure* while exploring the degree of pressure an individual feels from the *media* and related to *emotional and behavioural consequences* (e.g., ED, anxiety or depressive disorders);

g. Screen about CSz as many AOO or adolescents with ED may feel *anxious* about being weighted during the medical consult by the physician;
h. Explore the AOO desire in wearing ergonomic footwear with an unstable rounded sole (including economic conditions).
i. Promote cultural and body uniqueness while empowering these patients.
j. Promote social inclusion through a sense of style.

3. In, Physical examination, *fashion-related approaches* might be applied as the following:
    a. Evaluation of biomechanical characteristics before AOO join an exercise training programme and increase their physical activity to adequate sports footwear.

Implications for research

Many found studies in AOO include a wide age range of participants. Taking into account the important development changes through time – both cognitive and physical – there is a need to further develop research by narrowing the age range. This might be especially important when studying the influence of fashion-related mediators. Its influence may vary along with the adolescent age range. Additionally, further research should increase the number of male participants to fill the gap in the knowledge about the drivers of obesity and weight loss in this group. Also, there might be differences across cultures/ethnicities and that could be taken into account to better understand this possible influence of fashion-related mediators.

As this is a new field of study, there is a need to increase knowledge about the influence of plus-size models and influencers on social media. Both raising, and so, different conclusions might be observed. Plus, further studies could possibly evaluate the correlation of these raising models and influencers with BMI. Because, recent studies found that BMI was not found to be significantly associated with fear of fat, weight bias, or media use (Felicitas et al., 2015; Jeffers et al., 2013).

Future research could be done to further understand the possible mechanisms that may explain why AOO may be more inclined to restrict their food intake upon reading anti-

obesity narratives to understand the possible adverse events related to media use (such as the development of ED).

Regarding the development of footwear adapted to AOO, future studies could develop special intervention programmes to evaluate effectively the possibility of improvement of gait parameters, adherence to physical exercise and BMI changes. Also, the influence of hairstyle on physical exercise needs to be further evaluated to see if it is cultural/ethnical dependent. In addition, it would be interesting to evaluate if there are changes in body image/body satisfaction/body dissatisfaction mediated by the willingness to improve physical appearance, including the willingness to wear clothing that make AOO see themselves positively. Also, evaluating how these mediators might contribute to long-term adherence to physical exercise.

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SUPPLEMENTARY DATA

Fashion-related approaches to the Clinical Management of Adolescents with Overweight & Obesity

Table S1 – Body mass index (BMI) by sex, age and educational attainment level. Data exported from Eurostat, 2021. PC: Percentage; ISCED: International Standard Classification of Education; GEO: Geopolitical entity; F – female; M – male; T – total; PT – Portugal.

UNIT	BMI	ISCED11	SEX	AGE	GEO	TIME PERIOD	VALUE
PC	BMI 25-29	TOTAL	F	Y15-24	PT	2014	15
PC	BMI 25-29	TOTAL	F	Y15-24	PT	2019	12.2
PC	BMI 25-29	TOTAL	M	Y15-24	PT	2014	18.2
PC	BMI 25-29	TOTAL	M	Y15-24	PT	2019	22.4
PC	BMI 25-29	TOTAL	T	Y15-24	PT	2014	16.6
PC	BMI 25-29	TOTAL	T	Y15-24	PT	2019	17.3
PC	BMI ≥ 30	TOTAL	F	Y15-24	PT	2014	4.9
PC	BMI ≥ 30	TOTAL	F	Y15-24	PT	2019	8.6
PC	BMI ≥ 30	TOTAL	M	Y15-24	PT	2014	5.3
PC	BMI ≥ 30	TOTAL	M	Y15-24	PT	2019	5.8
PC	BMI ≥ 30	TOTAL	T	Y15-24	PT	2014	5.1
PC	BMI ≥ 30	TOTAL	T	Y15-24	PT	2019	7.1

Table S2 – Judgements from the risk of bias assessment for included experimental studies using RoB (Revised Cochrane risk-of-bias tool for randomized trials).

Unique ID	1SCS	Study ID	Maffiuletti, Malatesta, Agosti, & Sartorio, 2012	Assessor	De-Oliveira
Ref or Label	10.1016/j.amjmed.2012.01.001	Aim	assignment to intervention (the 'intention-to-treat' effect)		
Experimental		Comparator		Source	Journal article(s)
Outcome	Changes in Metabolic Rate	Results		Weight	

Domain	Signalling question	Response	Comments
Bias arising from the randomization process	1.1 Was the allocation sequence random?	NI	
	1.2 Was the allocation sequence concealed until participants were enrolled and assigned to interventions?	PY	
	1.3 Did baseline differences between intervention groups suggest a problem with the randomization process?	N	
	Risk of bias judgement	Low	"Individuals act as their own control. The experiments were conducted in 2 conditions (unstable shoes vs conventional shoes) randomly presented."
Bias due to deviations from intended interventions	2.1.Were participants aware of their assigned intervention during the trial?	Y	however, Individuals act as their own control and didn't know when were using the shoes related to intervention or the conventional shoes.
	2.2.Were carers and people delivering the interventions aware of participants' assigned intervention during the trial?	NI	
	2.3. If Y/PY/NI to 2.1 or 2.2: Were there deviations from the intended intervention that arose because of the experimental context?	N	P value, Wilcoxon Signed Rank Test
	2.4 If Y/PY to 2.3: Were these deviations likely to have affected the outcome?	NA	
	2.5. If Y/PY/NI to 2.4: Were these deviations from intended intervention balanced between groups?	NA	
	2.6 Was an appropriate analysis used to estimate the effect of assignment to intervention?	Y	
	2.7 If N/PN/NI to 2.6: Was there potential for a substantial impact (on the result) of the failure to analyse participants in the group to which they were randomized?	NA	
	Risk of bias judgement	Low	The aim was selected as can be seen above, however, they assume that further research is needed to assess the actual impact of wearing unstable shoes on obesity treatment and prevention.
Bias due to missing outcome data	3.1 Were data for this outcome available for all, or nearly all, participants randomized?	Y	
	3.2 If N/PN/NI to 3.1: Is there evidence that result was not biased by missing outcome data?	NA	
	3.3 If N/PN to 3.2: Could missingness in the outcome depend on its true value?	NA	
	3.4 If Y/PY/NI to 3.3: Is it likely that missingness in the outcome depended on its true value?	NA	
	Risk of bias judgement	Low	
Bias in measurement of the outcome	4.1 Was the method of measuring the outcome inappropriate?	N	
	4.2 Could measurement or ascertainment of the outcome have differed between intervention groups?	N	
	4.3 Were outcome assessors aware of the intervention received by study participants?	NI	
	4.4 If Y/PY/NI to 4.3: Could assessment of the outcome have been influenced by knowledge of intervention received?	N	because the assessment was objective and do not involve judgment.
	4.5 If Y/PY/NI to 4.4: Is it likely that assessment of the outcome was influenced by knowledge of intervention received?	NA	
	Risk of bias judgement	Low	
Bias in selection of the reported result	5.1 Were the data that produced this result analysed in accordance with a pre-specified analysis plan that was finalized before unblinded outcome data were available for analysis?	Y	
	5.2 ... multiple eligible outcome measurements (e.g. scales, definitions, time points) within the outcome domain?	N	
	5.3 ... multiple eligible analyses of the data?	NI	Analysis intentions are not available, or the analysis intentions are not reported in sufficient detail to enable an assessment, and there is more than one way in which the outcome measurement could have been analysed.
	Risk of bias judgement	Some concerns	
Overall bias	**Risk of bias judgement**	Some concerns	

Unique ID	1RCT	Study ID	Shentow-Bewsh, Keating, & Mills, 2016	Assessor	De-Oliveira
Ref or Label	10.1016/j.eatbeh.2015.11.012	Aim	assignment to intervention (the 'intention-to-treat' effect)		
Experimental	effects of exposure to a fictitious media article featuring obesity-stigmatizing content	Comparator	message control condition and neutral control task	Source	Journal article(s)
Outcome	Behaviour change; Emotional functioning; Food Behaviour	Results		Weight	

Domain	Signalling question	Response	Comments
Bias arising from the randomization process	1.1 Was the allocation sequence random?	Y	"Prior to their arrival, a random number generator was used to randomize participants to one of three experimental conditions"
	1.2 Was the allocation sequence concealed until participants were enrolled and assigned to interventions?	Y	
	1.3 Did baseline differences between intervention groups suggest a problem with the randomization process?	N	"Furthermore, the conditions did not differ significantly on BMI, age, hunger, time taken to read the articles, or on any pre-manipulation study variable."
	Risk of bias judgement	Low	
Bias due to deviations from intended interventions	2.1.Were participants aware of their assigned intervention during the trial?	PN	Although participants were aware of the intervention, they didn't know if they were the intervention or the control group. Therefore, we considered the participants as blind through the use of sham interventions.
	2.2.Were carers and people delivering the interventions aware of participants' assigned intervention during the trial?	NI	
	2.3. If Y/PY/NI to 2.1 or 2.2: Were there deviations from the intended intervention that arose because of the experimental context?	N	
	2.4 If Y/PY to 2.3: Were these deviations likely to have affected the outcome?	NA	
	2.5. If Y/PY/NI to 2.4: Were these deviations from intended intervention balanced between groups?	NA	
	2.6 Was an appropriate analysis used to estimate the effect of assignment to intervention?	Y	Missing Completely at Random test

	2.7 If N/PN/NI to 2.6: Was there potential for a substantial impact (on the result) of the failure to analyse participants in the group to which they were randomized?	NA	
	Risk of bias judgement	**Low**	
Bias due to missing outcome data	3.1 Were data for this outcome available for all, or nearly all, participants randomized?	Y	Nearly all = Missing Completely at Random test was not significant, χ2(18) = 16.87, p = .532.
	3.2 If N/PN/NI to 3.1: Is there evidence that result was not biased by missing outcome data?	NA	
	3.3 If N/PN to 3.2: Could missingness in the outcome depend on its true value?	NA	
	3.4 If Y/PY/NI to 3.3: Is it likely that missingness in the outcome depended on its true value?	NA	
	Risk of bias judgement	**Low**	
Bias in measurement of the outcome	4.1 Was the method of measuring the outcome inappropriate?	PN	they had pre-specified outcomes and hypothesis.
	4.2 Could measurement or ascertainment of the outcome have differed between intervention groups?	N	
	4.3 Were outcome assessors aware of the intervention received by study participants?	NI	
	4.4 If Y/PY/NI to 4.3: Could assessment of the outcome have been influenced by knowledge of intervention received?	N	
	4.5 If Y/PY/NI to 4.4: Is it likely that assessment of the outcome was influenced by knowledge of intervention received?	NA	
	Risk of bias judgement	**Low**	
Bias in selection of the reported result	5.1 Were the data that produced this result analysed in accordance with a pre-specified analysis plan that was finalized before unblinded outcome data were available for analysis?	Y	
	5.2 ... multiple eligible outcome measurements (e.g. scales, definitions, time points) within the outcome domain?	N	all data were reported and compared
	5.3 ... multiple eligible analyses of the data?	N	all data were reported and compared
	Risk of bias judgement	**Low**	
Overall bias	**Risk of bias judgement**	**Low**	GOOD

Unique ID	2RCT	**Study ID**	Wyssen, Coelho, Wilhelm, Zimmermann, & Munsch, 2016	**Assessor**	De-Oliveira
Ref or Label	10.1016/j.jbtep.2016.03.010	**Aim**	assignment to intervention (the 'intention-to-treat' effect)		
Experimental	exposure to social media related to appearance	**Comparator**	nature magazine	**Source**	Journal article(s)
Outcome	Emotional functioning; Food Behaviour	**Results**		**Weight**	

Domain	**Signalling question**	**Response**	**Comments**
Bias arising from the randomization process	1.1 Was the allocation sequence random?	Y	"Thought-shape fusion in young healthy females appears after vivid imagination of thin ideals."
	1.2 Was the allocation sequence concealed until participants were enrolled and assigned to interventions?	Y	
	1.3 Did baseline differences between intervention groups suggest a problem with the randomization process?	N	
	Risk of bias judgement	**Low**	
Bias due to deviations from intended interventions	2.1.Were participants aware of their assigned intervention during the trial?	PN	"participants are informed that they participate in a study investigating psychological well-being and psychophysiological responses to daily stressors in young women. Additionally, we only asked the participants not to inform other participants about the proce- dure during the experiment, but cannot guarantee that the content of the study was not disclosed."
	2.2.Were carers and people delivering the interventions aware of participants' assigned intervention during the trial?	Y	
	2.3. If Y/PY/NI to 2.1 or 2.2: Were there deviations from the intended intervention that arose because of the experimental context?	N	
	2.4 If Y/PY to 2.3: Were these deviations likely to have affected the outcome?	NA	
	2.5. If Y/PY/NI to 2.4: Were these deviations from intended intervention balanced between groups?	NA	
	2.6 Was an appropriate analysis used to estimate the effect of assignment to intervention?	Y	"more statistical power to detect actually existing study effects and to lead to less biased results, in the case of dropouts, relative to models based on the randomized block/split-plot design approach."
	2.7 If N/PN/NI to 2.6: Was there potential for a substantial impact (on the result) of the failure to analyse participants in the group to which they were randomized?	NA	
	Risk of bias judgement	**Low**	
Bias due to missing outcome data	3.1 Were data for this outcome available for all, or nearly all, participants randomized?	Y	"nearly all: Due to an administrative error, responses of five participants were not recorded at T1. Assuming that non-recorded data were missing at random, we used multiple imputation to estimate those missing data"
	3.2 If N/PN/NI to 3.1: Is there evidence that result was not biased by missing outcome data?	NA	
	3.3 If N/PN to 3.2: Could missingness in the outcome depend on its true value?	NA	
	3.4 If Y/PY/NI to 3.3: Is it likely that missingness in the outcome depended on its true value?	NA	
	Risk of bias judgement	**Low**	
Bias in measurement of the outcome	4.1 Was the method of measuring the outcome inappropriate?	N	
	4.2 Could measurement or ascertainment of the outcome have differed between intervention groups?	N	
	4.3 Were outcome assessors aware of the intervention received by study participants?	Y	
	4.4 If Y/PY/NI to 4.3: Could assessment of the outcome have been influenced by knowledge of intervention received?	N	
	4.5 If Y/PY/NI to 4.4: Is it likely that assessment of the outcome was influenced by knowledge of intervention received?	NA	
	Risk of bias judgement	**Low**	
Bias in selection of	5.1 Were the data that produced this result analysed in accordance with a pre-specified analysis plan that was finalized before unblinded outcome data were available for analysis?	Y	
	5.2 ... multiple eligible outcome measurements (e.g. scales, definitions, time points) within the outcome domain?	N	

the reported result	5.3 ... multiple eligible analyses of the data?	PN	data is fully reported
	Risk of bias judgement	**Some concerns**	although data is fully reported, multiple eligible analyses of the data were done; however, they were compared and discussed.
Overall bias	**Risk of bias judgement**	**Some concerns**	

Unique ID	3RCT	**Study ID**	Rubinstein et al., 2017	**Assessor**	De-Oliveira
Ref or Label	10.1080/19424280.2017.1363821	**Aim**	assignment to intervention (the 'intention-to-treat' effect)		
Experimental	Overweight and obese group	**Comparator**	normal-weight group	**Source**	Journal article(s)
Outcome	Physical activity	**Results**		**Weight**	

Domain	**Signalling question**	**Response**	**Comments**
Bias arising from the randomization process	1.1 Was the allocation sequence random?	PN	there is no information & there are no word limits for papers in this journal.
	1.2 Was the allocation sequence concealed until participants were enrolled and assigned to interventions?	NI	
	1.3 Did baseline differences between intervention groups suggest a problem with the randomization process?	N	
	Risk of bias judgement	**Some concerns**	
Bias due to deviations from intended interventions	2.1.Were participants aware of their assigned intervention during the trial?	PY	the intervention was running and the experimental group were obese/overweight and the contol group was normal-weight
	2.2.Were carers and people delivering the interventions aware of participants' assigned intervention during the trial?	Y	
	2.3. If Y/PY/NI to 2.1 or 2.2: Were there deviations from the intended intervention that arose because of the experimental context?	N	
	2.4 If Y/PY to 2.3: Were these deviations likely to have affected the outcome?	NA	
	2.5. If Y/PY/NI to 2.4: Were these deviations from intended intervention balanced between groups?	NA	
	2.6 Was an appropriate analysis used to estimate the effect of assignment to intervention?	PN	
	2.7 If N/PN/NI to 2.6: Was there potential for a substantial impact (on the result) of the failure to analyse participants in the group to which they were randomized?	PN	
	Risk of bias judgement	**Low**	
Bias due to missing outcome data	3.1 Were data for this outcome available for all, or nearly all, participants randomized?	Y	
	3.2 If N/PN/NI to 3.1: Is there evidence that result was not biased by missing outcome data?	NA	
	3.3 If N/PN to 3.2: Could missingness in the outcome depend on its true value?	NA	
	3.4 If Y/PY/NI to 3.3: Is it likely that missingness in the outcome depended on its true value?	NA	
	Risk of bias judgement	**Low**	
Bias in measurement of the outcome	4.1 Was the method of measuring the outcome inappropriate?	N	
	4.2 Could measurement or ascertainment of the outcome have differed between intervention groups?	N	
	4.3 Were outcome assessors aware of the intervention received by study participants?	Y	
	4.4 If Y/PY/NI to 4.3: Could assessment of the outcome have been influenced by knowledge of intervention received?	N	
	4.5 If Y/PY/NI to 4.4: Is it likely that assessment of the outcome was influenced by knowledge of intervention received?	NA	
	Risk of bias judgement	**Low**	
Bias in selection of the reported result	5.1 Were the data that produced this result analysed in accordance with a pre-specified analysis plan that was finalized before unblinded outcome data were available for analysis?	Y	
	5.2 ... multiple eligible outcome measurements (e.g. scales, definitions, time points) within the outcome domain?	N	
	5.3 ... multiple eligible analyses of the data?	N	
	Risk of bias judgement	**Low**	
Overall bias	**Risk of bias judgement**	**Some concerns**	

Unique ID	4RCT	**Study ID**	Oldham, Tomiyama, & Robinson, 2018 (Study 1)	**Assessor**	De-Oliveira
Ref or Label	10.1016/j.appet.2018.05.002	**Aim**	assignment to intervention (the 'intention-to-treat' effect)		
Experimental	Obese body suit	**Comparator**	standard clothing	**Source**	Journal article(s)
Outcome	Food Behaviour; Emotional functioning	**Results**		**Weight**	

Domain	**Signalling question**	**Response**	**Comments**
Bias arising from the randomization process	1.1 Was the allocation sequence random?	Y	"Participants were randomly allocated (via an online random number generator) to one of four conditions (obese body suit public, obese body suit private, control public, control private)."
	1.2 Was the allocation sequence concealed until participants were enrolled and assigned to interventions?	Y	
	1.3 Did baseline differences between intervention groups suggest a problem with the randomization process?	N	
	Risk of bias judgement	**Low**	
	2.1.Were participants aware of their assigned intervention during the trial?	PN	"Participants in the obese body suit conditions were asked to wear a body prosthetic designed to make them appear obese with standard clothing over the top. Whereas participants in the control clothing conditions were shown the standard clothing (identical to that worn in the obese body suit condition)and were asked to select a clothing size that would fit best. However, in order to determine which participants had guessed the aims, two

Bias due to deviations from intended interventions	2.2.Were carers and people delivering the interventions aware of participants' assigned intervention during the trial?	Y	independent researchers coded participant responses. In order to be excluded participants had to explicitly link the study clothing with how much they ate during the taste test. Cases of disagreement were reconciled by a third researcher. Also, In order to disguise the true research aims, participants were told that the study was concerned with how physical appearance impacted perception."
	2.3. If Y/PY/NI to 2.1 or 2.2: Were there deviations from the intended intervention that arose because of the experimental context?	N	
	2.4 If Y/PY to 2.3: Were these deviations likely to have affected the outcome?	NA	
	2.5. If Y/PY/NI to 2.4: Were these deviations from intended intervention balanced between groups?	NA	
	2.6 Was an appropriate analysis used to estimate the effect of assignment to intervention?	Y	
	2.7 If N/PN/NI to 2.6: Was there potential for a substantial impact (on the result) of the failure to analyse participants in the group to which they were randomized?	NA	
	Risk of bias judgement	**Some concerns**	Although the study has a plan to determine which participants had guessed the aims, it is a bit implicit for the participants regarding what they are wearing. That can induce a bias.
Bias due to missing outcome data	3.1 Were data for this outcome available for all, or nearly all, participants randomized?	Y	
	3.2 If N/PN/NI to 3.1: Is there evidence that result was not biased by missing outcome data?	NA	
	3.3 If N/PN to 3.2: Could missingness in the outcome depend on its true value?	NA	
	3.4 If Y/PY/NI to 3.3: Is it likely that missingness in the outcome depended on its true value?	NA	
	Risk of bias judgement	Low	
Bias in measurement of the outcome	4.1 Was the method of measuring the outcome inappropriate?	PN	
	4.2 Could measurement or ascertainment of the outcome have differed between intervention groups?	N	
	4.3 Were outcome assessors aware of the intervention received by study participants?	PY	
	4.4 If Y/PY/NI to 4.3: Could assessment of the outcome have been influenced by knowledge of intervention received?	N	
	4.5 If Y/PY/NI to 4.4: Is it likely that assessment of the outcome was influenced by knowledge of intervention received?	NA	
	Risk of bias judgement	Low	
Bias in selection of the reported result	5.1 Were the data that produced this result analysed in accordance with a pre-specified analysis plan that was finalized before unblinded outcome data were available for analysis?	Y	
	5.2 ... multiple eligible outcome measurements (e.g. scales, definitions, time points) within the outcome domain?	N	
	5.3 ... multiple eligible analyses of the data?	N	
	Risk of bias judgement	Low	
Overall bias	**Risk of bias judgement**	**Some concerns**	It is possible to guess the aim of the study as the participants were mimicking an obese with the body suit. However, in order to determine which participants had guessed the aims, "two independent researchers coded participant responses. In order to be excluded participants had to explicitly link the study clothing with how much they ate during the taste test. Cases of disagreement were reconciled by a third researcher. Also, in order to disguise the true research aims, participants were told that the study was concerned with how physical appearance impacted perception."

Unique ID	5RCT	**Study ID**	Oldham, Tomiyama, & Robinson, 2018 (Study 2)	**Assessor**	De-Oliveira
Ref or Label	10.1016/j.appet.2018.05.002	**Aim**	assignment to intervention (the 'intention-to-treat' effect)		
Experimental	Obese body suit woman	**Comparator**	standard clothing, men	**Source**	Journal article(s)
Outcome	Food Behaviour; Emotional functioning	**Results**		**Weight**	

Domain	**Signalling question**	**Response**	**Comments**
Bias arising from the randomization process	1.1 Was the allocation sequence random?	Y	"Participants were randomly allocated (via an online random number generator) to one of four conditions (obese body suit public, obese body suit private, control public, control private)."
	1.2 Was the allocation sequence concealed until participants were enrolled and assigned to interventions?	Y	
	1.3 Did baseline differences between intervention groups suggest a problem with the randomization process?	N	
	Risk of bias judgement	Low	
Bias due to deviations from intended interventions	2.1.Were participants aware of their assigned intervention during the trial?	PN	"Participants in the obese body suit conditions were asked to wear a body prosthetic designed to make them appear obese with standard clothing over the top. Whereas participants in the control clothing conditions were shown the standard clothing (identical to that worn in the obese body suit condition)and were asked to select a clothing size that would fit best. However, in order to determine which participants had guessed the aims, two
	2.2.Were carers and people delivering the interventions aware of participants' assigned intervention during the trial?	Y	independent researchers coded participant responses. In order to be excluded participants had to explicitly link the study clothing with how much they ate during the taste test. Cases of disagreement were reconciled by a third researcher. Also, In order to disguise the true research aims, participants were told that the study was concerned with how physical appearance impacted perception."
	2.3. If Y/PY/NI to 2.1 or 2.2: Were there deviations from the intended intervention that arose because of the experimental context?	N	
	2.4 If Y/PY to 2.3: Were these deviations likely to have affected the outcome?	NA	
	2.5. If Y/PY/NI to 2.4: Were these deviations from intended intervention balanced between groups?	NA	
	2.6 Was an appropriate analysis used to estimate the effect of assignment to intervention?	Y	
	2.7 If N/PN/NI to 2.6: Was there potential for a substantial impact (on the result) of the failure to analyse participants in the group to which they were randomized?	NA	
	Risk of bias judgement	**Some concerns**	Although the study has a plan to determine which participants had guessed the aims, it is a bit implicit for the participants regarding what they are wearing. That can induce a bias.
	3.1 Were data for this outcome available for all, or nearly all, participants randomized?	Y	

Bias due to missing outcome data	3.2 If N/PN/NI to 3.1: Is there evidence that result was not biased by missing outcome data?	NA	
	3.3 If N/PN to 3.2: Could missingness in the outcome depend on its true value?	NA	
	3.4 If Y/PY/NI to 3.3: Is it likely that missingness in the outcome depended on its true value?	NA	
	Risk of bias judgement	**Low**	
Bias in measurement of the outcome	4.1 Was the method of measuring the outcome inappropriate?	PN	
	4.2 Could measurement or ascertainment of the outcome have differed between intervention groups?	N	
	4.3 Were outcome assessors aware of the intervention received by study participants?	PY	
	4.4 If Y/PY/NI to 4.3: Could assessment of the outcome have been influenced by knowledge of intervention received?	N	
	4.5 If Y/PY/NI to 4.4: Is it likely that assessment of the outcome was influenced by knowledge of intervention received?	NA	
	Risk of bias judgement	**Low**	
Bias in selection of the reported result	5.1 Were the data that produced this result analysed in accordance with a pre-specified analysis plan that was finalized before unblinded outcome data were available for analysis?	Y	
	5.2 ... multiple eligible outcome measurements (e.g. scales, definitions, time points) within the outcome domain?	N	
	5.3 ... multiple eligible analyses of the data?	N	
	Risk of bias judgement	**Low**	
Overall bias	**Risk of bias judgement**	**Some concerns**	It is possible to guess the aim of the study as the participants were mimicking an obese with the body suit. However, in order to determine which participants had guessed the aims, "two independent researchers coded participant responses. In order to be excluded participants had to explicitly link the study clothing with how much they ate during the taste test. Cases of disagreement were reconciled by a third researcher. Also, in order to disguise the true research aims, participants were told that the study was concerned with how physical appearance impacted perception."

Unique ID	1SMI	**Study ID**	Llauradó et al., 2021	**Assessor**	De-Oliveira
Ref or Label	10.1111/hex.13406	**Aim**	assignment to intervention (the 'intention-to-treat' effect)		
Experimental		**Comparator**		**Source**	Journal article(s)
Outcome	Social functioning; School functioning	**Results**		**Weight**	1

Domain	Signalling question	Response	Comments
Bias arising from the randomization process	1.1 Was the allocation sequence random?	NI	"Portugal, CZ and the UK did not conduct any scientific assessment. However, Spain completed a study based on a parallel-cluster, randomized, controlled, school-based, peer-led social marketing intervention that was approved by the Ethics Committee (ref: 14–04–24/4proj2) and was registered at clinicaltrials.gov (NCT02157402)."
	1.2 Was the allocation sequence concealed until participants were enrolled and assigned to interventions?	N	
	1.3 Did baseline differences between intervention groups suggest a problem with the randomization process?	N	
	Risk of bias judgement	**High**	
Bias due to deviations from intended interventions	2.1.Were participants aware of their assigned intervention during the trial?	Y	"Peer leaders' initial training: CZ and Portugal developed brainstorming activities to begin the design of activities. In contrast, the training of peer leaders from Spain focused on education about healthy lifestyles, health communication through social media and social marketing for 4 h. For peer leaders from the UK, a social marketing agency developed the initial training based on building adolescent communication skills and self-confidence. This training was presented in two 3-h sessions."
	2.2.Were carers and people delivering the interventions aware of participants' assigned intervention during the trial?	Y	
	2.3. If Y/PY/NI to 2.1 or 2.2: Were there deviations from the intended intervention that arose because of the experimental context?	PN	podem estar a desenvolver capacidades para as quais estejam mais motivados tendo em conta que participaram no desenho do estudo.
	2.4 If Y/PY to 2.3: Were these deviations likely to have affected the outcome?	NA	
	2.5. If Y/PY/NI to 2.4: Were these deviations from intended intervention balanced between groups?	NA	
	2.6 Was an appropriate analysis used to estimate the effect of assignment to intervention?	PY	
	2.7 If N/PN/NI to 2.6: Was there potential for a substantial impact (on the result) of the failure to analyse participants in the group to which they were randomized?	NA	
	Risk of bias judgement	**Low**	
Bias due to missing outcome data	3.1 Were data for this outcome available for all, or nearly all, participants randomized?	Y	
	3.2 If N/PN/NI to 3.1: Is there evidence that result was not biased by missing outcome data?	NA	
	3.3 If N/PN to 3.2: Could missingness in the outcome depend on its true value?	NA	
	3.4 If Y/PY/NI to 3.3: Is it likely that missingness in the outcome depended on its true value?	NA	
	Risk of bias judgement	**Low**	
Bias in measurement of the outcome	4.1 Was the method of measuring the outcome inappropriate?	N	
	4.2 Could measurement or ascertainment of the outcome have differed between intervention groups?	N	
	4.3 Were outcome assessors aware of the intervention received by study participants?	Y	
	4.4 If Y/PY/NI to 4.3: Could assessment of the outcome have been influenced by knowledge of intervention received?	N	
	4.5 If Y/PY/NI to 4.4: Is it likely that assessment of the outcome was influenced by knowledge of intervention received?	NA	
	Risk of bias judgement	**Low**	
Bias in selection of the reported result	5.1 Were the data that produced this result analysed in accordance with a pre-specified analysis plan that was finalized before unblinded outcome data were available for analysis?	Y	
	5.2 ... multiple eligible outcome measurements (e.g. scales, definitions, time points) within the outcome domain?	N	
	5.3 ... multiple eligible analyses of the data?	N	
	Risk of bias judgement	**Low**	
Overall bias	**Risk of bias judgement**	**High**	

Table S3 – Publications and presentations related to the master thesis.

TITLE	TYPE	DATA	LOCATION	ID/LINK
Fashion-Related Approaches in The Clinical Management of Adolescent Overweight and Obesity	Publication	21 NOV, 2021	PROSPERO	CRD42021292701
Adolescentes com Obesidade – Novas Perspetivas sobre a Gestão Clínica da Obesidade em Adolescentes	Presentation	10 NOV, 2021	USF do Mosteiro, Odilevas	---
Implications For Clinical Practice – Including Fashion-Related Approaches in Psychosocial & Clinical Management of Adolescents with Overweight and Obesity	Presentation	11 MAR, 2022	Centro Hospitalar Universitário do Algarve – Hospital de Faro – Departamento de Psiquiatria e Saúde Mental	---
Fashion-related approaches to the psychosocial and clinical management of adolescents with overweight & obesity: a systematic review and meta-analysis	Journal Publication	27 APRIL, 2022	Journal of Menta Health	CJMH-2022-0228

Proof of submission for publication the systematic review "Fashion-related approaches to the psychosocial and clinical management of adolescents with overweight & obesity: a systematic review and meta-analysis" at the Journal Menta Health

Journal of Mental Health

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Thank you for your submission

Submitted to
Journal of Mental Health

Manuscript ID
CJMH-2022-0228

Title
Fashion-related approaches to the psychosocial and clinical management of adolescents with overweight & obesity: a systematic review and meta-analysis

Authors
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Date Submitted
27-Apr-2022

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