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Effects of Swimming on the Body Composition of Individuals with Down Syndrome: A Systematic Review

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Abstract--- In the literature, it has been determined that various training models are applied to optimize the body health and body composition of individuals with Down Syndrome (DS). Although it has been reported in review studies that many training models are effective in improving the body health and body composition of individuals with DS, there is no consensus among researchers about how swimming exercises affect the body health and body composition of individuals with DS. In this context, the aim of the research is to reach a conclusion by utilizing the studies examining the effects of swimming on the body compositions of individuals with DS. This research was designed using the systematic review method and findings were obtained through this method. A total of 8689 articles were found in the search made on Web of Science and Google Scholar databases, and as a result of the evaluation made within the scope of the inclusion and exclusion criteria of the research, 8 articles were included in the research. As a result of the research findings, it has been concluded that there is no consensus among researchers about the effects of swimming on the body composition of individuals with DS, and also that very few studies have been conducted on this subject. Therefore, it is recommended to conduct more research on this subject.

Keywords--- Body Composition, Down Syndrome, Swimming.

I. Introduction

Down Syndrome (DS) is a genetic disorder that results from the presence of all or part of a third copy of chromosome 21, the most common chromosomal abnormality in humans (Roizen, 2002). People with DS are typically limited to a variety of physical challenges such as neuromuscular control, balance, strength, endurance, and cardio-respiratory fitness (Sugimoto, 2016). Therefore, physical activity levels of individuals with DS are generally lower compared to their non-DS peers (Shields et al.,2018; Whitt-Glover, 2006). In addition, a large percentage of individuals with DS are overweight or obese (Terblanche and Boer, 2013; Melville et al.,2008). Being overweight or obese significantly increases the risk of many serious diseases and death arteria (World Health Organization). Physical activity is of great importance in the treatment of obesity (Yılmaz et al., 2018). Improving the level of physical activity and increasing energy use may be important strategies for achieving target body composition (Swift et al., 2014). In this context, it is very important to identify exercise practices that improve body health and positively affect body composition (İlbak and Bayer, 2021).

In the literature, it has been determined that various training models are applied to optimize the body health and body composition of individuals with DS. Aerobic exercises (Varela et al., 2001), aerobic exercises combined with resistance training (Mendonca et al., 2011), strength and agility development exercises (Lin and Wuang, 2012), yoga practices (Mousavı and Jirsaraei, 2020) and swimming exercises (Suarez-Villadat, 2020; Naczk et al., 2021) are some of these applications. Although it has been reported in review studies that many training models are effective in improving the body health and body composition of individuals with DS (Barnard et al., 2019; Ruiz-González et

al., 2019; Dodd and Shields, 2005), there is no consensus among researchers about how swimming exercises affect the body health and body composition of individuals with DS.

Suarez-Villadat et al., (2020) applied swimming exercises to individuals with DS for 36 weeks, 3 times a week. At the end of the study, it showed that a 36-week swimming program consisting of 3 sessions per week of 50 minutes was able to reduce body composition levels in a sample of adolescents with Down syndrome. In a similar study by Naczk et al., (2021), it was reported that 33-week swimming exercises resulted in significant decreases in body mass, body fat and body mass index (BMI) of individuals with DS. In another study, Boer (2020) had an exercise group consisting of individuals with DS do freestyle swimming training 3 times a week for 8 weeks. As a result of the research, it was reported that there was a statistical difference between the body mass and body mass index of the control and experimental groups in favor of the experimental group. However, González-Ravé (2020) stated that no decrease was observed in the body mass of individuals with DS participating in 18-week swimming sessions. Similarly, Casey et al., (2010) reported that the body fat percentage of individuals with intellectual disabilities (ID) (some of the participants with down syndrome) who participated in 16-week swimming exercises did not decrease. In this context, this issue is worth investigating since there is still no consensus among researchers about the effects of swimming exercises on the body composition of individuals with DS.

The aim of this research is to reach a conclusion by utilizing the studies examining the effects of swimming activity on the body compositions of individuals with DS.

II. Materials and Methods

In the literature, review studies are generally conducted with three different methods: systematic review, traditional review and meta-analysis (Moula& Goodman, 2009; Gerrish& Lacey, 2010). This research was designed using the systematic review method.

A systematic review consists of synthesizing the findings obtained from the studies included in the research by examining all the studies published in the relevant field within the framework of various inclusion and exclusion criteria in order to answer a question or find a solution to a problem (Burns & Grove, 2007; Burns & Grove, 2009).

Criteria of Inclusion in the Research

- The relevant researches should be conducted between 2010 andyear 2022.
- The research should be published in English.
- The participant group of research should be consisted of individuals with Down syndrome.
- The exercise program applied in the research has been composed of swimming exercises.

Criteria of Exclusion in the Research

- The relevant researches should not be conducted between 2010and year of 2022.
- The research has not been published in English.
- The participant group of research has not been consisted of individuals with Down syndrome.
- The exercise program applied in the research has not been composed of swimming exercises.

Scanning Strategy and Data Collection

Research data will be collected considering the inclusion and exclusion criteria of the research published as a result of the search made by scanning the keywords "down syndrome, swimming, body composition" in English on Web of Science and Google Scholar databases in electronic environment between 25.06.2022-30.07.2022.

69 articles were found in the first search on the Web of Sciencedatabase using previously determined keywords. In the first evaluation made within the scope of inclusion and exclusion criteria, 5 articles were found suitable for the study and were included in the study, while 64 studies were excluded. In the first evaluation made within the scope of inclusion and exclusion criteria on the Google Scholar database, 3 articles were found suitable for the study and were included in the study, while the 83 were exluded,which made a total of 8 studies that were included in the research (Figure 1).

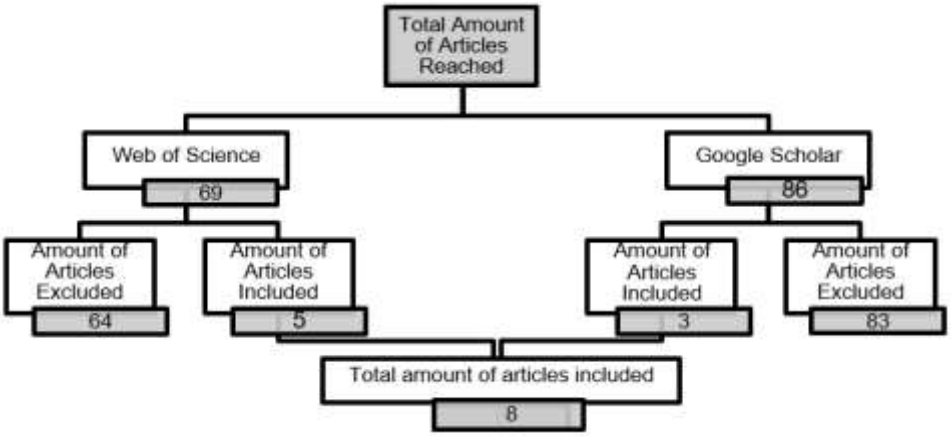

Figure 1: The Total Amount of Articles Reached Within the Scope of Inclusion and Exclusion Criteria

III. Results

As a result of the literature review, the findings obtained from the articles included in the research within the scope of the inclusion criteria are shown in the table below (Table 1).

Table 1: The Total Amount of Articles Reached within the Scope of Inclusion and Exclusion Criteria

Author and year	Sample of participants	Measurments	Training duration	Conclusion
Suarez-Villadat et al., (2020)	45 participants with mean age 13.71±1.24 years	BMI, WC, WtHR, BF%, SM	36 weeks (3 days per week)	Swimming program consisting of 3 sessions per week for 36 weeks can improvebody composition individuals with DS.
Naczk et al., (2021)	22 individuals with DS with the mean age 14.65±2.16	Height, BM, BMI, BF%, VO^2max	33 weeks (3 days per week).	Significant decreases were observed in the BM, BF% and BMI of the participants of the 33-week.
Casey et al., (2010)	8 participants with mean age 13.1±3.4	BMI, BMI z Score, BF%	16 weeks (3 days per week).	It was reported that the BF% of participants did not decrease after the 16-week.
González-Ravé (2020)	9 participants with age 21-30	BM, FM, FFM	18 weeks (3 days per week).	18-week swimming program had no statistically significant differences
Boer (2020)	26 individuals with mean age 32.7 ± 6	BM, BMI	8 weeks (3 days per week).	Statistical difference in BM andBMI values of individuals with DS
Boer and de Beer (2019)	23 individuals - mean age 31.2 ± 7.4	BMIHeight	6 weeks (3 days per week).	BM and BMI did not change after swimming program
Oprișescu and Bălan (2019)	3 individuals with mean age of 12.6 ± 0.1	BW, BF%, WC, BMI, SM, Height	Between 39 and 46 classes of swimming	Swimming program had no positive effects on tested parameters of participants
Pérez et al., (2018)	14 adults (mean age 37±7.24 years)	BMI, ST, WC	12 weeks (2 times a week with a 1 sessions 45 minutes long)	Swimming program had no statistically significant effects on BW and BMI and WC

Legend: BMI – body mass index (kg/m2); WC - waist circumference (cm); WtHR - Waist-to-Height-Ratio; BF% - Body Fat Percentage; SM - Skinfold Measurements (mm); BM – Body mass (kg); VO^2max - maximum of oxygen uptake (mL/kg/min); FM – fat mass (kg); FFM – free fat mass (kg).

IV. Discussion and Conclusion

As a result of this research, which aimed to examine the studies examining the effects of swimming on the body compositions of individuals with DS, very few studies (n=8) on this subject (Suarez-Villadat et al., 2020; Naczk et

al., 2021; Casey et al., 2010; González-Ravé, 2020; Boer, 2020; Pérez et al., 2018; Oprişescu and Bălan, 2019; Boer and de Beer, 2019) (Table 1). Therefore, it is recommended that researchers do more research on this subject.

In the scope of selected articles, there was a population that had to fulfill inclusion criteria (people with DS) in order to be presented in Table 1.The total number of participants was 150 among all the displayed articles. The number of participants varied from research to research, the smallest number of respondents was included in the research of Oprişescu and Bălan (2019) with only 3 participants, and the largest number in the research of Suarez-Villadat et al., (2020) with 45 participants.

Anthropometric measurements, which are frequently used in sports sciences and fields related to public health, to evaluate the body composition of individuals are simple, inexpensive, easy and reliable methods. The most common ones are BMI, waist circumference and waist-hip ratio (Kafri et al., 2014; Kreissl et al., 2019).In addition, body mass, body fat ratio, lean body mass measurements are among the most commonly used measurements. In studies examining the effects of swimming on individuals with DS, the measurements applied to determine the effects of swimming consist of some of these measurements.

As a result of the findings obtained from the articles included in this study, it has been determined that there is no consensus yet on how swimming has an effect on the body composition of individuals with DS. Suarez-Villadat et al., (2020), Naczk et al., (2021) and Boer (2020) reported that swimming has positive effects on the body composition of individuals with DS, while Casey et al., (2010), González-Ravé (2020), Boer and de Beer (2019), Oprişescu and Bălan (2019) and Pérez et al., (2018) reported that swimming did not have positive effects on the body composition of individuals with DS.

In order to summarize the positive effects of swimming on the body composition of people with DS, the details, both similarities and differences, of the exercise programs that have been applied in the articles: Suarez-Villadat et al., (2020), Naczk et al., (2021) and Boer (2020) will be presented. In this context, given that the exercise programs were of different durations, it can be said that the duration of the program does not play a significant role in determining the effects on body composition. However, considering the similarities, all studies have included crawl swimming in the program and achieved good results (Suarez-Villadat et al., 2020; Naczk et al., 2021; Boer, 2020). Looking at the differences between the programs, that caused positive changes in body composition, it is observed that: the research of Suarez-Villadat et al., (2020) used equipment for swimming in the pool during the whole program, while the program of Naczk et al., (2021) based on swimming without equipment after 8 weeks (after the people with DS learned basic swimming technique). Furthermore, Boer (2020) reported that an 8-week freestyle swimming program of three days per week for 30-40 minutes improved body composition in terms of BM and BMI. According to the results of the presented studies, it can be said that the type of swimming program and the duration of the program are not important in improving the body composition of people with DS.

There are more articles that report that there areno statistically significant differences on body composition caused by swimming programs (Casey et al., 2010; González-Ravé, 2020; Boer and de Beer, 2019; Oprişescu and Bălan, 2019; Pérez et al., 2018) (Table 1).

Casey et al., (2010) report that swimming 1000m per training, for 3 days per week during 16 weeks, does not have a positive effect on body composition with individuals with DS. In addition, González-Ravé (2020) stated that a swimming program, which lasted 18 weeks with 3 days of training per week, with 3 zones of training, ranging from 65-100% (heart rate max.) did not have a significant impact on FM, FFM and BM on individuals with DS. Furthermore, Boer and Beer (2019), concluded that a swimming program of 6 weeks (3 times a week for 35-45 min.), with an individual approach did not have a significant effect on BM and BMI of participants with DS. Moreover, in the study of Oprişescu, Bălan (2019) declared that participants with DS had no positive effects on BW, BF%, WC, BMI and SM during swimming lessons over 39-46 classes. As a further matter, Pérez et al., (2019) reported that a swimming program of 2 days per week (45 minutes a session) for 12 weeks did not have statistically significant effects on BMI, ST, WC of individuals with DS.

As a result of the articles previously mentioned, it has been concluded that there is no consensus among researchers about the effects of swimming on the body composition of individuals with DS and also that very few studies have been conducted on this subject. However, it should be noted that none of these studies included any type of intervention in the diets of the participants. It is, therefore, thought that this is the main reason for the inconsistencies between studies.

It is known that increasing energy use in the body is an important strategy in reaching the target body composition (Swift et al., 2014). However, if there is not a balanced relationship between the amount of energy taken and the amount of energy spent, it is very likely that various problems will arise.Therefore, in future studies, it is thought that controlling the nutrition of the participants may be a more effective strategy in determining the effects of swimming on the body compositions of individuals with DS.

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