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Research article

Retrospective analysis of the Special Olympics Health Promotion database for nutrition-specific variables

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ABSTRACT

Background: Studies have shown that individuals with intellectual disabilities (ID) exhibit a high prevalence of obesity and poor-quality diet. The population of individuals with ID include athletes that participate in Special Olympics.
Aim: In order to develop appropriate educational programs for the Special Olympics Athletes in Connecticut, a baseline of the various health and nutrition variables needed to be established by examining the existing data in the Special Olympics International's Health Promotion database.
Methods: A retrospective analysis was performed using data from the Special Olympics International (SOI) Health Promotion database. The study population included athletes at least 20 years of age ($n = 47,932$) and divided into sub-groups of non-USA, USA and Connecticut (CT). The data was provided by SOI to the research team in a de-identified form covering the time frame of 2014–2019. The existing data was originally collected by trained SO volunteers and included age, height, weight, bone mineral density (BMD), blood pressure (BP) variables and a health habits questionnaire. In addition to basic descriptive statistics, analysis was performed using Chi Squared Analysis and ANOVA with post-hoc. A significance level of p value ≤ 0.05 was used for all analyses.
Results: Results show a high prevalence of obesity, high blood pressure, low bone mineral density and a poor-quality diet across all groups. CT athletes were older and had a more even distribution by gender compared to the non-USA and USA groups. CT athletes had a high prevalence of obesity, HTN, and low BMD, as well as, a poor quality diet reflected by high frequency of consumption of sweetened beverages, fast food and snack food. CT athletes also did not consume the recommended daily servings of calcium containing foods or fruits and vegetables.
Conclusion: This data will be used to develop educational programs that will help to improve the overall health of Special Olympics Athletes in Connecticut.

What this paper adds?

A retrospective analysis was performed using data from the drastically underutilized Special Olympics International Health Promotion database which is the largest database specific to individuals with intellectual disabilities. The findings from this study have generated new insights about the differences between non-USA, USA and Connecticut Special Olympic athletes for various health and nutrition indicators, an area of research that has not received enough attention thus far. Statistically significant results show a high prevalence of obesity, high blood pressure, low bone mineral density and a poor-quality diet across all groups including athletes internationally, in the U.S. and in Connecticut.

1. Introduction

Approximately, 1–3% of the U.S. population has a diagnosed intellectual or developmental disability (American Association on Intellectual and Developmental Disabilities, 2012). The American Association on Intellectual and Developmental Disabilities (2012) defines intellectual and developmental disabilities (IDD) as significant limitations in both adaptive behavior (including social skills, practical skills and conceptual skills) and intellectual functioning (IQ < 75) which originate before the individual is 18 years of age. Studies have consistently shown that health disparities exist with a higher prevalence of certain chronic diseases such as obesity, cardiovascular disease, osteoporosis and type 2 diabetes in individuals with IDD compared to the general

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population (Hsieh et al., 2013; Melville et al., 2007; Robertson et al., 2014; Draheim, 2006; Lauer and McCallion, 2015; Reichard et al., 2011; Balogh et al., 2015; Shireman et al., 2010). Studies have also shown that individuals with IDD are often inactive with increased sedentary behavior and consume a poor quality diet (Robertson et al., 2014; Bartlo and Klein, 2011; Sundahl et al., 2015; Adolfsson et al., 2008; Draheim et al., 2007; Stancliffe et al., 2011). Further contributing to the increased weight in this population are a genetic predisposition (Farooqi and O'Rahilly, 2005) medications that can lead to weight gain (Hsieh et al., 2013; Stancliffe et al., 2011; De Winter et al., 2012), and, certain living situations resulting in limited autonomy over individual health behaviors (Stancliffe et al., 2011; De Winter et al., 2012; Melville et al., 2007).

1.1. Emphasis on provision of nutrition services

In a position statement from the Academy of Nutrition and Dietetics (2015), emphasis is placed on the need to provide nutrition services throughout the lifetime of individuals with IDD. In addition to the above, individuals with IDD experience many additional issues necessitating the need for nutrition interventions such as failure to thrive, metabolic disorders, inadequate feeding skills, drug-nutrient interactions and for some, the need for nutrition support through enteral or parenteral feeding modalities. Incorporation of effective nutrition interventions can decrease the risk of developing these chronic diseases and help to manage complications from the disease while improving the individual's quality of life.

1.1.1. Obesity, additional chronic diseases and poor diet quality

Much of the available research in this population has focused on obesity. The prevalence of obesity appears greater in people with intellectual disabilities than those in the general population and higher obesity rates in combination with a diet poor in quality will increase the likelihood of the individual developing additional chronic diseases. Ranjan et al. (2018) found the prevalence of being overweight and obese among adults with intellectual disability to be 28%–71% compared to the general population of 17%–43%. Ranjan et al. (2018) went on to describe various factors contributing to the risk of being overweight or obese including being female, aging, having a certain diagnosis, mild intellectual disability, community-dwelling, certain prescription medications, and inactivity. With the emphasis now placed on supporting efforts for individuals with IDD to move to community-dwelling situations, more control over food choices and food preparation is now shifted onto the individual and can result in less than optimal dietary choices (Robertson et al., 2014; Bartlo and Klein, 2011; Sundahl et al., 2015; Adolfsson et al., 2008; Draheim et al., 2007; Stancliffe et al., 2011). In addition, further contributing to poor diet quality is the increase in restrictive eating patterns and limited food preferences in the IDD population placing these individuals at risk of nutritional deficiencies (Ranjan et al., 2018). Research has shown that adults with IDD have a typical diet that is low in fiber, fruit, vegetables and some of the micronutrients such as folate, iron, calcium, potassium and zinc, as well as being high in saturated fat and refined grains (Ptomey et al., 2013). Braunschweig et al. (2004) found an average daily intake of fruit (2.8 $\pm$ 2.6 servings) and vegetables (1.0 $\pm$ 1.2 servings) to be inadequate with none of the participants of their study meeting the recommended minimum of at least 5 servings of fruit and vegetables per day. Further, a study reporting scores from the Healthy Eating Index (HEI), which is a tool to measure diet quality, reported that obese individuals with IDD had lower scores (HEI score 45.6) suggesting poorer quality when compared to individuals in the general U.S. population (HEI score 58.2) (Ptomey et al., 2013).

1.1.2. International health promotion and Special Olympics

Several international and national organizations and initiatives have recognized the critical importance of improving diet quality and decreasing obesity in this population including the World Health Organization, the Academy of Nutrition and Dietetics, the U.S. Surgeon General and Healthy People 2020 (Ptomey et al., 2018). Another international organization that has a tremendous positive impact on the population of individuals with IDD is Special Olympics. Special Olympics was founded by Eunice Kennedy Shriver in 1968 and is an international organization that encourages and empowers individuals with ID (www.specialolympics.org) through programming in sports, health education and community building. Special Olympics is dedicated to promoting a healthy lifestyle and providing educational programming and resources to help the athletes improve their overall health and athletic performance. A critical component of leading a healthy lifestyle is to establish and maintain a nutritious diet and avoid nutritional deficiencies or excesses. As summarized above there is data available on the nutritional needs and status of individuals with intellectual disorders in general but very little is known about the underserved Special Olympics athlete population specifically. Special Olympics International has been conducting free Healthy Athletes screenings at local, national and international events and incorporating the data into the largest international database specifically on the health of people with intellectual disabilities (Lloyd et al., 2018). Key messages promoted by the Healthy Athletes Program include the promotion of 5 fruits and vegetables a day, foods high in calcium, water as a substitute for high sugar beverages, portion sizes and daily physical activity.

1.1.3. Obesity trends in the Special Olympics population

In one of the few studies specifically examining obesity trends in the Special Olympics population, Foley et al. (2014) determined the prevalence of obesity was significantly higher for Special Olympics female participants when compared to a control group from the National Health and Nutrition Examination Survey. In another of the available studies specific to the Special Olympics population, Catugna and Vickery (2003) described their 2002 experience piloting a Wellness Park to add nutrition, blood pressure, and flexibility screening to the existing dental and eye screenings. Participants ranging in age from 8-63 years old had a prevalence of overweight of 32% and obesity of 17%. Further, an increased waist circumference was found in 25% of males and 73% of females.

1.1.4. Closing the health disparity gap

In an effort to close the health disparity gap for individuals participating in Special Olympics, additional targeted health and nutrition educational programming needs to be developed to improve diet quality, reduce obesity and decrease the incidence of chronic diseases and complications in this population. In order to develop educational programs focusing on improving health for the Special Olympics Athletes in Connecticut, a baseline of the various health and nutrition variables needed to be established by examining the existing data in the Special Olympics International's Health Promotion database (Lloyd et al., 2018). Therefore, our research question was as follows: *What is the current status for health and nutrition indicators in Special Olympics Connecticut athletes as compared to United States Special Olympics athletes and international Special Olympics athletes?*

2. Methods

2.1. Participants

The study population included male and female athletes at least 20 years of age that participate in the Special Olympics Healthy Athletes Screening Program. To be eligible to participate in Special Olympics Programs, the individual must have a diagnosed intellectual disability, cognitive delay or related developmental disability. The age criteria of at least 20 years of age was selected since that is the required age for several of the screenings to be performed such as body mass index (BMI) and bone mineral density (BMD) tests. BMD was included in this study since individuals with IDD have an increased fracture risk. Special Olympics

Connecticut has over 12,000 athletes competing in their sports programs including Unified Sports® (https://www.soct.org/about-us/about-special-olympics-connecticut-soct/). However, only a sub-set of that population are part of the Special Olympics Connecticut's Healthy Athletes screenings that fit the criteria for this project. The goal was to obtain complete datasets on at least 25% of the athletes that are part of the Special Olympics Connecticut's Healthy Athletes screenings with equivalent or greater numbers for comparative national (USA) and international groups (non-USA). These athletes participate in at least one of the Healthy Community programs in addition to the health screenings. The Healthy Communities initiative raises awareness of health and health systems partnerships and increases attention on the health disparities individuals with ID face. Healthy Communities advocates in the private and public sector for more inclusive health practices and empowers athletes and caregivers to be their own advocates. At the time of the study, the sample pool for Connecticut Special Olympics athletes was 860 athletes that met the inclusion criteria. The target sample size was 215 (25% of 860) which was thought to be enough to provide representative data.

2.2. Data collection

Data was collected from participants by SOI at Healthy Athletes screenings with the help of a proxy (e.g. parent/guardian/caregiver) when applicable. Approval to utilize the retrospective data was secured from both the University of Saint Joseph Institutional Review Board and Special Olympics International Institutional Review Board with informed consent obtained from participants prior to commencing the study. The study was conducted in accordance with the 1964 Declaration of Helsinki and its later amendments. The data was provided by SOI to the research team in a de-identified form covering the time frame of 2014–2019. The existing data was originally collected by trained Special Olympics volunteers for the age, height, weight, BMD and blood pressure (BP) variables with athlete self-report for all other data collected. Height was measured using a free-standing stadiometer to the nearest 0.1cm (Perspective Enterprises Portable Adult Measuring Unit ™). Weight was measured using a high-quality beam balance scale or digital scale to the nearest 0.1kg (examples of approved scales for use were Doran DS6100 and SECA 869-Health O Meter 752 KL). BMI was calculated as weight (kg)/height $(m)^2$ and further classified by the WHO (1995) classifications. BMD was assessed using a Sahara Ultrasound Machine as per manufacturer instructions. Both the left heel and right heel were measured and the lowest of the two resulting T-scores was used to categorize the data as normal (T-score -1 to +1; equates to very low risk of bone fracture), low bone mineral density (T-score < -1) or high bone mineral density (T-score $> +3.5$) as compared to a healthy 30 year-old (WHO study group, 1994). BP was measured using a digital sphygmomanometer with an appropriately sized arm cuff for the individual (adult cuff or extra-large cuff) as mmHg systolic over mmHg diastolic from the right and left arms. Participants were then categorized based on results (Low: $<90/60$, Normal: $<120/80$, Pre-hypertension: $\geq 120/80$ but $<140/90$, hypertension: $\geq 140/90$) in accordance with the 2017 Report of the American College of Cardiology/American Heart Association (ACC/AHA) Task Force on Clinical Practice Guidelines (ACC/AHA, 2017). Participants were advised to avoid smoking, eating, and physical activity 30 min prior to taking a reading in order to provide more accurate results. Blood pressure measurements were repeated on the same arm if the measurement was higher than normal blood pressure cut-offs of 120mmHg/80mmHg and if still higher than normal, a third measurement would be taken using the opposite arm. In addition to the health screenings, each athlete participated in a health habits survey developed for standard use in the Special Olympics athlete population (Healthy Athletes, 2018; Harmeson et al., 2010). Health habits questions asked about beverage consumption, calcium containing foods, fruit and vegetable intake, fast food consumption, and snack food consumption and included pictures of the items to aid comprehension. The categories of fast food and snack food were included due to their typically high content of sodium, total fat, saturated fat, and added sugars which may have a negative impact on health. Examples of fast food would be a burger, fries and cola from a popular fast food chain restaurant. Examples of snack foods would be potato chips, cookies, pastries etc. Brand names and logos were illustrated as well to aid recognition. Visuals of the different items were provided and the athletes were aided by the help of a proxy as needed.

2.3. Data comparison

Data from Connecticut Special Olympics athletes (“CT”) was compared to the nationwide data for Special Olympics athletes in the USA (grouped together as “USA”) and to the international data from other participating countries (grouped together as “non-USA”). Age data was further categorized into ranges (20–29, 30–39, 40–49, 50–59, and 60 + years). Dichotomous data, such as “male or female”, were coded as [0:male] or [1:female]. Data from multiple choice questions were coded with however many numbers are required to cover all of the options. Prior to statistical analysis, the data was cleaned and any data errors or extreme outliers (defined as a score three times the interquartile range of the distribution of scores for the sample) were removed. In addition to basic descriptive statistics, analysis was performed using Chi Squared Analysis and ANOVA with post-hoc. A significance level of p value ≤ 0.05 was used for all analyses.

3. Results

The overall sample size was $n = 47{,}932$ with 61.5% males and 38.5% females. The overall average age was 32.3 ± 10.9 years (range 20–85 years) with an average age for males and females of 31.9 ± 10.8 and 32.8 ± 11.1, respectively. The percentage of participants from non-USA regions was 56.8% with 41.4% participants from the USA and 1.8% from CT. The 1.8% of participants from CT equated to $n = 864$; therefore, the target sample size of $n = 215$ for CT participants was met. CT participants were significantly older than all groups (36.1 ± 12.1 years vs. 30.4 ± 10.1 non-USA and 34.7 ± 11.5 USA, $p \leq 0.05$). All groups had significantly more male participants and all groups had the most representation in the 20–29 year old age group. CT had statistically less male participants and more female participants than both non-USA and USA resulting in a more even distribution.

3.1. Body mass index

Table 1 illustrates the overall results for BMI and for classification into BMI categories. The overall BMI was 27.8 ± 7.4 kg/m^2. The average BMI for males was 26.9 ± 6.7 kg/m^2 and was significantly lower than for females (29.3 ± 8.1 kg/m^2, $p \leq 0.05$). The average BMI for participants from non-USA regions of 25.9 ± 6.3 kg/m^2 was significantly lower than USA (30.7 ± 7.9 kg/m^2, $p \leq 0.05$) and CT (29.7 ± 6.8 kg/m^2, $p \leq 0.05$) (Table 1). Overall data for BMI categories reveals 5.1% of participants were underweight, 34.6% normal, 27.7% overweight and 32.6% obese. A similar pattern was found for male participants (5.5% underweight, 38.0% normal, 29.2% overweight and 27.3% obese); however, female participants had a significantly lower percentages of underweight and overweight but higher percentage classified as obese compared to males (4.4% underweight, 29.2% normal, 25.3% overweight and 41.1% obese, $p \leq 0.05$). Non-USA participants had significantly higher percentages classified as underweight and normal with less overweight and obese compared to both USA and CT. CT also had significantly more participants classified as overweight and obese compared to USA but less classified as underweight (See Table 1 for full data).

Table 1. Health indicators by region.[a]

	Non-USA (n = 24711)		USA (n = 16560)		Connecticut (n = 738)	
	X ± SD		X ± SD		X ± SD	
BMI (kg/m^2), n = 42009	25.9 ± 6.3[c,d]		30.7 ± 7.9[b]		29.7 ± 6.8[b]	
Age in years, n = 47932	30.4 ± 10.1[c,d]		34.7 ± 11.5[b,d]		36.1 ± 12.1[b,c]	
	Non-USA (n = 27209)		USA (n = 19859)		Connecticut (n = 864)	
Age Groups, n = 47932	n	%	n	%	n	%
20-29, n = 24441	15946	58.6[c,d]	8168	41.1[b,d]	327	37.8[b,c]
30-39, n = 12738	6589	24.2[c,d]	5915	29.8[b,d]	234	27.1[b,c]
40-49, n = 6342	2921	10.7[c,d]	3268	16.5[b,d]	153	17.7[b,c]
50-59, n = 3292	1380	5.1[c,d]	1807	9.1[b,d]	105	12.1[b,c]
60+, n = 1119	373	1.4[c,d]	701	3.5[b,d]	45	5.2[b,c]
Gender, n = 47932	n	%	n	%	n	%
Males, n = 29463	17572	64.6[c,d,e]	11408	57.4[b,d,e]	483	55.9[b,d,e]
Females, n = 18469	9637	35.4[c,d,e]	8451	42.6[b,d,e]	381	44.1[b,d,e]
	Non-USA (n = 24475)		USA (n = 16488)		Connecticut (n = 733)	
BMI Categories (kg/m^2)[f], n = 41696	n	%	n	%	n	%
Underweight (<18.5), n = 2125	1763	7.2[c,d]	355	2.2[b,d]	7	1.0[b,c]
Normal (18.5–24.9), n = 14432	10571	43.2[c,d]	3694	22.4[b]	167	22.8[b]
Overweight (25.0–29.9), n = 11558	6695	27.4[c]	4624	28.0[b,d]	239	32.6[b,c]
Obese (≥30), n = 13581	5446	22.3[c,d]	7815	47.4[b,d]	320	43.7[b,c]
	Non-USA (n = 22897)		USA (n = 18052)		Connecticut (n = 811)	
BP Categories (mmHg)[f], n = 41760	n	%	n	%	n	%
Low (<90/60), n = 4898	3417	14.9[c,d]	1415	7.8[b]	66	8.1[b]
Normal (<120/80), n = 14063	7515	32.8[c,d]	6260	34.7[b,d]	288	35.5[b,c]
Pre-HTN (≥120/80 but <140/90), n = 6353	3590	15.7[c,d]	2653	14.7[b,d]	110	13.6[b,c]
HNT (≥140/90), n = 16446	8375	36.7[c,d]	7724	42.8[b]	347	42.9[b]
	Non-USA (n = 6942)		USA (n = 8213)		Connecticut (n = 339)	
BMD Categories (T-score)[f], n = 15494	n	%	n	%	n	%
Low (<-1), n = 4629	2255	32.5[c]	2263	27.6[b,d]	111	32.7[c]
Normal (-1 to +1), n = 10666	4626	66.6[c]	5815	70.8[b,d]	225	66.4[c]
High (>+3.5), n = 199	61	0.9[c]	135	1.6[b,d]	3	0.9[c]

[a] Because of rounding, some percentages may add up to slightly more or less than 100%.
[b] p≤0.05 vs Non-USA.
[c] p≤0.05 vs USA.
[d] p≤0.05 vs Connecticut.
[e] p≤0.05 male vs female.
[f] Abbreviations: BMI, body mass index; BP, blood pressure; BMD, bone mineral density.

3.2. Blood pressure

Table 1 also illustrates the results when the participants were classified into BP categories. Overall, 11.7% of participants had low BP, 33.7% normal BP, 15.2% pre-hypertension, and 39.4% hypertension. Male participants were categorized as 10.6% with low BP, 29.5% normal BP, 17.1% pre-hypertension, and 42.9% hypertension revealing statistically higher blood pressure levels compared to females (13.5% with low BP, 40.3% normal BP, 12.2% pre-hypertension, and 33.9%, $p \leq 0.05$). Non-USA participants were categorized as 14.9% with low BP, 32.8% normal BP, 15.7% pre-hypertension, and 36.7% hypertension (Table 2). The non-USA blood pressure levels were statistically lower than both USA and CT levels (See Table 1 for full data).

3.3. Bone density

Table 1 also illustrates results when the participants were classified into bone density categories. Overall, 29.9% of participants were classified as having low bone density, 68.8% normal, and 1.3% high. For male participants, 30.5% were classified as having low bone density, 68.4% normal and 1.1% high. For female participants, 29.1% were classified as having low bone density, 69.4% normal and 1.5% high. CT had statistically more participants classified with low bone density when compared to USA ($p \leq 0.05$) (See Table 1 for full data).

3.4. Beverages

When asked what the participants usually drink when thirsty, overall 88.2% selected water, 34.1% selected fruit juice, 34.7% selected soft drinks, 17.6% selected sports drinks, 29.0% selected milk products, and 4.1% selected energy drinks (Table 2). When comparing males and females, females selected water and milk products significantly more than males and less soft, sports and energy drinks ($p \leq 0.05$). Lastly, CT participants had a significantly higher prevalence for all beverages compared to non-USA and USA ($p \leq 0.05$ vs non-USA and USA except for energy drinks which was $p \leq 0.05$ vs USA only). Specifically for sweetened beverage consumption, the overall frequency was 14.3% never, 12.9% monthly, 34.6% weekly and 38.1% daily (Table 2). Males and females reported similar frequency for sweetened beverage consumption with no differences between males and females. Both the USA and CT participants reported a statistically higher frequency of sweetened beverage consumption compared to non-USA ($p \leq 0.05$) (See Table 2 for full data).

3.5. Fast food and snack food consumption

Table 2 shows data for the frequency of fast food and snack food consumption with 18.9% selecting never, 31.0% monthly, 40.6% weekly and 9.5% daily. For snack food consumption, 14.0% selected never,

Table 2. Nutrition, food and beverage habits.[a]

	Overall		Males		Females		Non-USA		USA		Connecticut	
	n	%	n	%	n	%	n	%	n	%	n	%
What do you usually drink when you are thirsty? [select all that apply]												
Water	36829	88.2	22551	87.9[b]	14278	88.8	21350	89.6[d,e]	17099	86.1[c,e]	42	93.6[c,d]
Fruit Juice	14233	34.1	8738	34.0	5495	34.2	8230	34.5[d,e]	5672	32.9[c,e]	331	50.2[c,d]
Soft Drink	14477	34.7	9012	35.1[b]	5465	34.0	7000	29.4[d,e]	7176	41.6[c,e]	301	45.6[c,d]
Sports Drink	7340	17.6	4904	19.1[b]	2436	15.2	2224	9.3[d,e]	4918	28.5[c,e]	198	30.0[c,d]
Milk Product	12104	29.0	7319	28.5[b]	4785	29.8	5450	22.9[d,e]	6324	36.6[c,e]	330	50.0[c,d]
Energy Drink	1716	4.1	1233	4.8[b]	483	3.0	992	4.2	692	4.0[c,e]	32	4.8
Frequency of sweetened beverage consumption:												
Never	5692	14.3	3527	14.4	2165	14.1	4210	18.3[d,e]	1407	8.7[c,e]	75	13.8[c,d]
Monthly	5157	12.9	3150	12.9	2007	13.1	3619	15.8[d,e]	1471	9.1[c,e]	67	12.3[c,d]
Weekly	13731	34.6	8455	34.6	5276	34.5	8437	36.7[d,e]	5120	31.6[c]	174	32.0[c]
Daily	15155	38.1	9301	38.1	5854	38.3	6710	29.2[d,e]	8217	50.7[c,e]	228	41.9[c,d]
Frequency of fast food consumption:												
Never	7158	18.9	4310	18.5[b]	2848	19.4	5261	24.5[d,e]	1732	10.9[c,e]	165	26.7[c,d]
Monthly	11787	31.0	7022	30.1[b]	4765	32.5	6991	32.5[d,e]	4584	28.9[c,e]	212	34.4[c,d]
Weekly	15405	40.6	9530	40.9	5875	40.0	7554	35.2[d,e]	7642	48.1[c,e]	209	33.9[c,d]
Daily	3621	9.5	2434	10.4[b]	1187	8.1	1672	7.8[d,e]	1918	12.1[c,e]	31	5.0[c,d]
Frequency of snack food consumption:												
Never	5269	14.0	3073	13.3[b]	2196	15.1	3399	15.9[d,e]	1771	11.3[c,e]	99	18.1[c,d]
Monthly	5152	13.7	3063	13.2[b]	2089	14.3	3503	16.3[d,e]	1567	10.0[c,e]	82	15.0[c,d]
Weekly	13160	34.9	8172	35.3[ab]	4988	34.2	8137	38.0[d,e]	4870	31.0[c,e]	153	27.9[c,d]
Daily	14107	37.4	8812	38.1[b]	5295	36.3	6398	29.8[d,e]	7495	47.7[c,e]	214	39.1[c,d]
Number of servings of calcium containing foods per day:												
>5	1169	3.5	762	3.8	407	3.2	674	3.6[e]	488	3.6[e]	7	1.3[c,d]
3–5	5406	16.4	3225	16.0[b]	2181	17.1	2208	11.8[d,e]	3131	22.9[c,e]	67	12.2[c,d]
1–2	18603	56.5	11328	56.2	7275	56.9	10414	55.7[d,e]	7803	57.0[c,e]	386	70.3[c,d]
<1	6640	20.1	4144	20.5	2496	19.5	4568	24.4[d,e]	1993	14.6[c]	79	14.4[c]
Never	1136	3.4	712	3.5	424	3.3	846	4.5[d,e]	280	2.0[c]	10	1.8[c]
Number of servings of fruits and vegetables per day:												
>5	1826	6.0	1125	6.0	701	5.9	1082	6.2[d,e]	728	5.7[c,e]	16	2.9[c,d]
3–5	8854	28.9	5129	27.4[b]	3725	31.4	4399	25.4[d,e]	4221	33.2[c,e]	234	42.2[c,d]
1–2	14837	48.5	9189	49.0[b]	5648	47.6	8476	48.9[d]	6091	47.9[c,e]	270	48.7[d]
<1	4684	15.3	3030	16.2[b]	1654	13.9	3111	17.9[d,e]	1540	12.1[c,e]	33	6.0[c,d]
Never	408	1.3	274	1.5[b]	134	1.1	271	1.6[d,e]	136	1.1[c,e]	1	0.2[c,d]

[a] Because of rounding some percentages may add up to slightly more or less than 100%.
[b] $p \leq 0.05$ male vs female.
[c] $p \leq 0.05$ vs Non-USA.
[d] $p \leq 0.05$ vs USA.
[e] $p \leq 0.05$ vs Connecticut.

13.7% monthly, 34.9% weekly and 37.4% daily. Males consumed fast food and snack foods more frequently than females ($p \leq 0.05$). Regional results show that the USA participants consume fast food and snack food more frequently than non-USA and CT participants ($p \leq 0.05$) (See Table 2 for full data).

3.6. Calcium containing foods, fruits and vegetables

Table 2 also illustrates the data for the number of servings of calcium and servings of fruits and vegetables consumed each day. Overall, 3.5% consumed >5 servings per day, 16.4% 3–5 servings, 56.5% 1–2 servings, 20.1% < 1 serving, and 3.4% reporting never. Overall consumption of fruit and vegetables each day was 6.0% with >5 servings, 28.9% with 3–5 servings, 48.5% with 1–2 servings, 15.3% with <1 serving and 1.3% reporting never. No differences were found between males and females for calcium consumption except for fewer males consuming 3–5 servings per day and males consumed fewer servings of fruits and vegetables ($p \leq 0.05$). Regional results show that participants from CT appear to consume less servings of calcium and but more fruits and vegetables than non-USA and USA ($p \leq 0.05$) (See Table 2 for full data).

4. Discussion

In order to develop educational programs focusing on improving health for the Special Olympics Athletes in Connecticut, a baseline of the various health and nutrition variables needed to be established by examining the existing data in the Special Olympics International's Health Promotion database (Lloyd et al., 2018). Therefore, our research question was as follows: *What is the current status for health and nutrition indicators in Special Olympics Connecticut athletes as compared to United States Special Olympics athletes and international Special Olympics athletes?*

Overall, the results obtained in the present study are consistent with the literature reflecting a high prevalence of overweight and obesity in individuals with IDD (Hsieh et al., 2013; Melville et al., 2007; Robertson et al., 2014; Draheim, 2006; Lauer and McCallion, 2015; Reichard et al., 2011; Balogh et al., 2015; Shireman et al., 2010; Catugna and Vickery, 2003; Hoey et al., 2017). Specifically, one study reported a prevalence of

28.9% overweight and 38% obesity in individuals with IDD in the USA (Hsieh et al., 2013) compared to a prevalence of 28.0% overweight and 47.4% obesity in the current study. These figures can also be compared to the most recent National Health and Nutrition Examination Study, which is a representative sample of the USA population, and reports an obesity prevalence of 43.2% (2017–2018, www.cdc.gov/nchs). Previous international studies have reported 28–71% prevalence of overweight and obesity in individuals with IDD versus 17–43% in the general population (Shireman et al., 2010). These results are similar to the current data showing 27.4% overweight and 22.3% obesity for participants from non-USA regions. When examining overweight and obesity in CT athletes, we found similar prevalence of overweight (32.6%) and obesity (43.7%). The current data also aligns with previous findings that being female and of an older age coincide with a higher prevalence of obesity (Ranjan et al., 2018). When the overall percentages for overweight and obesity are combined, it equates to 60.3% of the Special Olympics population overall, 75.4% for USA and 76.3% for CT. The combined percentages for non-USA participants is less than the USA and CT at 49.7% but still cause for concern. There is also concern for the overall 7.2% of non-USA participants that fall into the underweight category due to the health risks associated with being underweight.

Interesting comparisons can be made with the SOPHIE study (Hoey et al., 2017). The SOPHIE study investigated "health and well-being" of individuals with IDD in the Special Olympics population in Ireland. The SOPHIE study had a much smaller sample size (n = 131; response rate 6.9%) with 59% males and included participants that were 16 years or older. Some contrasting results have been identified between this study and the current one. For instance, the SOPHIE study reported an overall BMI of 29.4 ± 6.1 versus 27.8 ± 7.4 in the current study. A more accurate comparison may even be to compare the SOPHIE results to the non-USA data which would be an average BMI of 25.9 ± 6.3. When the data was classified into BMI categories, the prevalence of overweight and obesity combined in the SOPHIE study was 75.0% versus 61.3% overall and 49.7% non-USA in the current study. These comparisons reveal a lower prevalence of overweight and obesity in the current study than the SOPHIE study. These differences could be related to the study design and recruitment procedures. SOPHIE recruited through registered services for individuals with IDD and required all participants to have a proxy reporter potentially limiting eligibility and yielding a less representative sample.

With 15.2% of the overall population in the current study having pre-hypertension and 39.4% with hypertension that yields a combined percentage of over half with higher than normal blood pressure levels. Further, while the majority of the population had normal bone mineral density, there was still about 1/3 that are categorized as low. Females not only had higher prevalence of obesity but also high blood pressure placing them at higher risk for health consequences such as cardiovascular disease, diabetes and bone fractures. Somewhat surprisingly, there was no difference in the prevalence of low BMD in males and females.

It can be difficult to make direct comparisons with other dietary habit studies given the different study designs but some general comparisons can be made. Previous studies have revealed an overall poor-quality diet in individuals with IDD and the present data support that (Robertson et al., 2014; Bartlo and Klein, 2011; Sundahl et al., 2015; Adolfsson et al., 2008; Draheim et al., 2007; Stancliffe et al., 2011; Ranjan et al., 2018; Ptomey et al., 2013; Braunschweig et al., 2004). Overall, participants had a high frequency of consumption of sweetened beverages, fast food and snack foods and low intake of calcium containing foods and fruits and vegetables. Males tended to consume fast food and snack foods more often than females and less calcium containing foods and fruits and vegetables.

If we compare the food and beverage habits, CT athletes tend to drink more beverages in general with specific emphasis on water, and less fast food and snack food than the other groups but consume more sweetened beverages than non-USA and less than USA. When examining whether or not the athletes meet the recommended daily servings of calcium each day [at least 3 servings per day], both CT and non-USA athletes are meeting the recommended amount less often than USA; however, data on the reason for this is not available. For instance, avoidance of good sources of calcium, such as dairy, could be related to lactose intolerance which may explain the low intake. CT athletes appeared to consume more fruits and vegetables than non-USA and USA, although only a small percentage of participants in all groups achieved the recommended amounts of servings per day of fruits and vegetables (5 or more servings). These results are in line with Braunschweig et al.'s (2004) report of low fruit and vegetable intake in individuals with IDD.

4.1. Strengths and limitations

While the large sample size and regional comparisons, with representation from both urban and rural areas, are strengths that result in valuable insight into health and nutrition indicators of the Special Olympics athlete population, the study is not without limitations. The health indicators were measured by trained staff; however, the food and beverage data were self-reported. Self-reported data always has potential for bias or under/over reporting. However, subjects were provided aid by trained individuals were provided pictorial examples when filling out the forms. This method of self-reported data is standard practice in this population. Further, the data is only representative of Special Olympics athletes that participate in Healthy Athletes; therefore, the data cannot be generalized to the Special Olympics population as a whole. Nor can the data be generalized to the ID population at-large. The level of disability was not measured in this study and participants may have had differing levels than the general ID population. There was also a limitation in how the fruit and vegetable servings were categorized making it difficult to accurately determine if participants were meeting the recommended amounts. The recommendation is for at least 5 servings per day but unfortunately, there was some overlap in the categories. For instance, if an individual consumed 5 servings he/she would have selected the category of 3–5. This design flaw could be corrected in the future by including categories of 3–4, and 5 or more servings.

4.2. Future studies

To our knowledge, the current study is the first of its kind and should be used as a building block for designing future studies. Future studies should focus on examining associations between the dietary factors and health indicators. For instance, CT has the highest prevalence of low BMD and also has the lowest intake of calcium containing foods. CT also has the highest combined prevalence of overweight and obesity and high blood pressure which may be connected to the low fruit and vegetable intake. These hypothesized associations must be determined by further analysis. Future studies should also investigate yearly data trends (such as whether the prevalence of obesity is increasing or decreasing) and include information on the sub-classes of obesity, medications that lead to weight gain, diagnosis and race/ethnicity. Data on who does the shopping, meal planning and cooking, as well as, living situation (at home with parent/guardian, group home, own home) should be analyzed as well. Lastly, future studies should measure the HEI which could provide a defined level of diet quality that is easy to compare across populations.

5. Conclusion

In an effort to close the health disparity gap for individuals participating in Special Olympics, additional targeted health and nutrition educational programming needs to be developed to improve diet quality, reduce obesity and decrease the incidence of chronic diseases and complications in this population. This study has established a baseline of the various health and nutrition variables using data from the Special Olympics International's Health Promotion database (Foley et al., 2014) CT athletes were older and had a more even distribution of male and female participants compared to the non-USA and USA groups. CT athletes had a high prevalence of obesity, HTN, and low BMD, as well as, a poor-quality diet reflected by high frequency of consumption of sweetened beverages, fast food and snack food. CT athletes also did not consume the recommended daily servings of calcium containing foods or fruits and vegetables. This data will be used to develop educational programs that will help to improve the overall health of Special Olympics Athletes in Connecticut.

Declarations

Author contribution statement

Kaneen Gomez-Hixson, Nicole Batista: Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Melissa Brown: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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