

Children with brain tumors have enhanced visceral adiposity compared to non-cancer controls: A preliminary analysis from the Canadian Study of Determinants of Endometabolic Health in Children (CanDECIDE) study

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Introduction

Brain tumors are the most common solid tumors in children, accounting for 20% of all childhood cancer. With advancing technologies in diagnosis and treatments, the survival rates in children with brain tumors have improved significantly over the past three decades. However, this emerging group of survivors of childhood brain tumors (SCBT) often develop chronic comorbidities after their treatments for the tumors.

One such comorbidity is obesity, which can negatively impact their quality of life and lifespan by driving the risks for cardiovascular diseases and type 2 diabetes.

While adiposity is an established major risk factor of cardiometabolic disorders in the general population, adiposity patterns in SCBT have not been determined.

The objectives of this study are:

1. To determine the adiposity patterns in SCBT compared to non-cancer controls
2. To determine how lifestyle and treatment factors influence these patterns.

Methods

- This is a prospective cohort study. So far, 167 participants have been enrolled.
- Participants were asked to complete a series of questionnaires examining diet, physical activity, and sleep.
- Anthropometric measurements included weight, height, waist circumference, hip circumference, body fat percentage, and blood pressure.
- Medical record was assessed to obtain brain tumor characteristics including types, location, and treatment modalities.
- Independent samples t-test and Chi-Square test were used to compare variables between SCBT and controls.
- Principal component analysis was used to identify major dietary pattern in SCBT based on eigenvalues >1.25 and varimax rotation.
- Multivariate Regression analysis was used to determine the factors associated with adiposity.

Results

Table 1 – Participants Descriptions

Variable	Control (n=108)	SCBT (n=59)	P-value
Age (years)	13.9±2.9	15.1±7.4	0.92
Female:Male	53:55	25:34	0.41
BMI	22.1±5.5	22.0±6.0	0.86
BMI category, No.(%)			
BMI<25 or BMI%ile<85	70(65.4)	37(62.7)	0.73
BMI≥25 or BMI%ile≥85	37(34.6)	22(37.3)	
Body Fat Percentage	22.8±10.4	26.1±10.5	0.047
Waist-to-Hip Ratio	0.82±0.09	0.87±0.08	<0.001
Waist-to-Height Ratio	0.45±0.08	0.48±0.08	0.007
Systolic blood pressure (mmHg)	107.1±10.7	104.1±11.4	0.085
Diastolic blood pressure (mmHg)	67.6±9.6	66.3±8.7	0.41
Physical activity level, No.(%)			
Active	99(91.7)	45(76.3)	0.006
Inactive	9(8.3)	14(23.7)	
Screen time on weekdays, No.(%)			
≤ 2 hours/day	35(32.4)	16(27.1)	0.48
> 2 hours/day	73(67.6)	43(72.9)	
Screen time on weekends, No.(%)			
≤ 2 hours/day	13(12.0)	10(16.9)	0.38
> 2 hours/day	95(88.0)	49(83.1)	
Sleep duration on weekdays (hrs/day)	8.9±1.7	9.2±1.4	0.17
Sleep duration on weekends (hrs/day)	10.2±2.0	9.9±1.3	0.22
Sleep-related breathing disorder, No.(%)			
SRBD scores ≤ 0.33	105(97.2)	52(88.1)	0.018
SRBD scores > 0.33	3(2.8)	7(11.9)	

Table 2 – Brain Tumor Characteristics

Variables	No. (%)
Brain tumor type	
CNS germ cell tumors	5(8.5)
PNET/Medulloblastoma	11(18.6)
Craniopharyngioma	2(3.4)
Ependymoma	2(3.4)
Subependymal giant cell astrocytoma	3(5.1)
Meningioma	1(1.7)
NF1, low grade glioma	10(16.9)
Non-NF1, low grade glioma	25(42.4)
Brain tumor location	
Supratentorial	28(47.5)
Infratentorial	31(52.5)
Brain tumor treatments	
Surgery	44(74.6)
Radiotherapy	24(40.7)
Chemotherapy	28(47.5)
No treatments	8(13.6)

References

- Heikens J, Ubbink MC, van der Pal HP, et al. Long term survivors of childhood brain cancer have an increased risk for cardiovascular disease. *Cancer*. 2000; 88(9):2116-2121.
- Savva SC, Tornaritis M, Savva ME, et al. Waist circumference and waist-to-height ratio are better predictors of cardiovascular disease risk factors in children than body mass index. *Int J Obes Relat Metab Disord*. 2000; 24(11):1453-1458.

Table 3 – Multivariate Regression Analysis adjusted for age and sex in SCBT

Variables	B(95%CI)	p-value
Body Fat %		
Brain tumor status	0.080(0.017,0.14)	0.014
Radiotherapy	0.16(0.061,0.25)	0.002
Chemotherapy	0.11(0.013,0.20)	0.027
Physical activity levels	-0.069(-0.11,-0.027)	0.002
Fatty food intake	0.056(0.006,0.11)	0.03
Waist-to-Hip Ratio		
Brain tumor status	0.027(0.013,0.041)	<0.001
Radiotherapy	0.005(-0.018,0.029)	0.64
Chemotherapy	0.013(-0.008,0.035)	0.23
Physical activity levels	-0.009(-0.018,0.0005)	0.062
Fatty food intake	0.010(0.002,0.022)	0.10
Waist-to-Height Ratio		
Brain tumor status	0.031(0.009,0.054)	0.007
Radiotherapy	0.034(-0.002,0.070)	0.066
Chemotherapy	0.039(0.006,0.072)	0.023
Physical activity levels	-0.23(-0.037,-0.009)	0.002
Fatty food intake	0.019(0.00004,0.038)	0.051

Conclusions

- In this preliminary report, SCBT have higher total and visceral adiposity despite having similar BMI to controls, and this is associated with female gender, chemoradiotherapy, physical inactivity, and increased fatty foods intake.
- These results identify multiple points of entry to design interventions that reduce adiposity, and may improve long-term outcomes in SCBT.
- Larger sample size with follow-up data are warranted to further evaluate the impact of brain tumor types and locations on changes in adiposity patterns over time.

