Additional file 1:

Plant-based, Fast-food, Western-contemporary, and Animal-based Dietary Patterns and Risk of Premature Aging in Adult Survivors of Childhood Cancer: a cross-sectional study

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Table S1. Mean intakes of food and nutrients by dietary patterns in adult survivors of childhood cancer: St. Jude Lifetime Cohort Study[1]

	Dietary patterns			
	Plant-based (n=617)	Fast-food (n=1,046)	Western contemporary (n=843)	Animal-based (n=398)
Food/ Food groups (g/1,000 kcal)				
Whole grains	35.9±40.0	18.7±26.7	14.7±19.9	17.8±25.0
Fruit	112.9±76.5	37.7±33.4	40.9±40.8	45.5±40.4
Cruciferous vegetables	18.6±21.6	4.6±4.8	7.6±8.9	11.3±13.1
Green leafy vegetables	54.9±46.9	11.6±13.2	20.8±22.3	22.1±25.6
Starchy vegetables	11.0±11.9	5.7±5.1	9.8±10.6	9.3±10.0
Other vegetables	68.6±61.0	22.1±27.1	28.9±34.1	27.3±34.1
Nuts and seeds	7.9±8.0	4.1±5.2	2.9±3.4	3.1±4.6
Legumes	9.7±12.9	3.9±4.7	6.0±7.5	11.9±18.7
Low-fat dairy	120.0±122.1	83.9±105.9	55.9±73.5	46.8±63.1
High-fat dairy	11.9±27.2	34.4±60.7	26.8±42.3	32.9±60.6
Non-fried fish	14.3±19.0	4.5±6.4	4.3±5.2	11.0±13.6
Processed meat	5.1±6.6	12.0±9.4	10.1±7.8	10.9±9.0
Sweets and dessert	7.0±6.0	16.0±16.5	10.3±8.6	8.8±8.1
Sugar sweetened beverages	63.2±99.7	257.5±233.3	198.7±194.1	161.9±167.0
Pasta or rice	33.7±25.0	31.6±20.6	48.7±33.5	49.0±33.6
Mexican food	9.2±9.8	10.2±10.6	15.0±14.0	17.1±18.8
French fries	5.2±5.9	9.4±8.2	15.5±13.0	9.8±9.3
Salty snack	5.1±5.4	8.0±7.9	8.3±7.0	4.7±4.4
Red meat	11.3±10.3	20.5±13.9	26.7±19.8	31.2±28.1

Poultry	11.2±13.7	8.8±9.1	12.2±14.5	19.8±23.4
Fried fish	1.7±2.1	2.5±2.9	2.3±2.6	7.7±9.6
Wine	12.3±32.6	3.6±9.8	2.8±8.2	3.6±8.2
Beer or liquor	22.0±45.8	29.2±77.0	13.7±39.0	36.3±91.8
Nutrients				
Carbohydrate (% of energy)	48.8±8.0	50.0±7.9	47.9±6.8	44.5±7.7
Protein (% of energy)	16.9±3.1	14.3±2.8	14.9±2.6	17.7±3.1
Total fat (% of energy)	35.1±6.3	35.6±5.8	37.6±5.3	37.0±5.3
Saturated fat (% of energy)	10.4±2.3	11.9±2.3	12.0±2.1	11.8±2.2
Added sugars (g/1,000 kcal)	26.2±12.9	45.9±21.8	37.7±19.5	28.7±15.2
Dietary fiber (g/1,000 kcal)	12.3±3.6	6.8±2.0	7.9±2.2	8.1±2.5
Folate (μg/1,000 kcal)	205.5±71.5	102.4±31.2	116.7±40.9	135.3±50.4
Beta-carotene (μg/1,000 kcal)	3929.9±2378.1	1137.7±676.8	1680.6±1138.3	2068.8±1457.5
Vitamin B6 (mg/1,000 kcal)	1.2±0.3	0.9±0.3	0.9±0.3	1.0±0.3
Vitamin B12 (μg/1,000 kcal)	3.0±1.1	2.6±0.9	2.4±0.8	3.3±1.4
Vitamin C (mg/1,000 kcal)	77.2±32.2	45.2±25.0	40.3±18.0	58.4±32.8
Vitamin E (mg/1,000 kcal)	5.2±1.5	3.3±0.9	3.7±1.0	3.8±1.1
Calcium (mg/1,000 kcal)	527.2±161.6	428.9±146.0	397.1±113.4	406.1±125.4

1.Variables were presented as means ± SDs.

Method S1:

Dietary Pattern Identification Method

Food intake data processing:

110 individual food items in the food frequency questionnaire were grouped into 48 categories based on similar nutrient content or culinary use. For example, spinach and green salad were combined into “green leafy vegetables”. Foods that did not belong to any specific group or that may indicate certain eating behavior (e.g., pizza, French fries, and wine) were left as a single food. The intake for each group was calculated by summing the intake of all associated items.

Dietary patterns were identified using a two-step method:

1. Factor Analysis: Factor analysis (PROC FACTOR procedure) was applied to the 48 food groups among survivors to determine co-consumed foods. The number of factors was identified using the eigenvalue >1.0 criterion and Velicer’s minimum average partial test, resulting in three factors. These factors were rotated using varimax rotation, and factor scores were calculated by weighting each food group’s intake with its corresponding factor loadings.

2. Cluster Analysis: Cluster analysis of the energy-adjusted factor scores was conducted using k-means clustering (PROC FASTCLUS). The cubic clustering criterion, pseudo-F, and pseudo-T-square statistics from PROC CLUSTER were used to determine the optimal number of clusters. Participants were ultimately categorized into four mutually exclusive dietary pattern groups.

Further details on the methods used to identify the four dietary patterns can be found in:

Lan T, Wang M, Ehrhardt MJ, Lanctot JQ, Jiang S, Armstrong GT, et al. Dietary Patterns and Their Associations with Sociodemographic and Lifestyle Factors in Adult Survivors of Childhood Cancer: A Cross-Sectional Study. *The American journal of clinical nutrition*. Jan 24 2024;doi:10.1016/j.ajcnut.2024.01.012

Table S2. St. Jude Lifetime Cohort Aging-Related Deficits Accumulation Index (DAI).

DAI Construct	SJLIFE ITEM[1]	Value/Criteria	DAI Item Weight
1. Can take bath/shower	Does your health now limit you in Bathing or dressing yourself? If so, how much?	Yes, limited a lot	1
		Yes, limited a little	0.5
		No, not limited at all	0
		Missing	-
2. Can walk	Does your health now limit you in Walking 100 yards? If so, how much?	Yes, limited a lot	1
		Yes, limited a little	0.5
		No, not limited at all	0
		Missing	-
3. Health limited moderate activities	Does your health now limit you in Moderate activities? If so, how much?	Yes, limited a lot	1
		Yes, limited a little	0.5
		No, not limited at all	0
		Missing	-
4. Can eat and dress	Because of any impairment of health problems, do you need the help of other persons with personal care needs, such as eating, bathing dressing or getting around your home?	Yes	1
		No	0
		Missing	-
5. Take care of oneself	Because of any impairment or health problems do you need the help of other persons in handling routine needs, such as everyday household chores, doing necessary business, shopping, or getting around for other purposes?	Yes	1
		No	0
		Missing	-
6. Trouble getting to bathroom on time	Have you ever been told by a doctor or other health care professional that you have or have had urinary incontinence?	Yes, and the condition is still present	1
		No or yes, but the condition is no longer present	0
		Missing	-
7. Health limited climbing stairs	Does your health now limit you in climbing several flights of stairs? If so, how much?	Yes, limited a lot	1
		Yes, limited a little	0.5
		No, not limited at all	0
		Missing	-
8. Can go shopping for groceries or clothes	Does your health now limit you in lifting or carrying groceries? If so, how much?	Yes, limited a lot	1
		Yes, limited a little	0.5
		No, not limited at all	0
		Missing	-
9. Can do your housework	During the past 4 weeks, how much did pain interfere with your normal	Extremely	1
		Quite a bit	0.75

DAI Construct	SJLIFE ITEM[1]	Value/Criteria	DAI Item Weight
	work, including both work outside the home and housework?	Moderately	0.5
		A little bit	0.25
		Not at all	0
		Missing	-
10. Pain	How much bodily pain have you had during the past 4 weeks?	Very severe	1
		Severe	0.8
		Moderate	0.6
		Mild	0.4
		Very mild	0.2
		None	0
		Missing	-
11. General health	In general, how would you say your health is?	Poor	1
		Fair	0.75
		Good	0.5
		Very good	0.25
		Excellent	0
		Missing	-
12. Physical health limited work or activities	During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of your physical health? A: Cut down on the amount of time you spent on work or other activities	All of the time	1
		Most of the time	0.75
		Some of the time	0.5
		A little of the time	0.25
		None of the time	0
		Missing	-
13. Emotional problems limited work or activities	During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems? A: Cut down on the amount of time you spent on work or other activities.	All of the time	1
		Most of the time	0.75
		Some of the time	0.5
		A little of the time	0.25
		None of the time	0
		Missing	-
14. Physical or emotional health interfered with social activities	During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?	Extremely	1
		Quite a bit	0.75
		Moderately	0.5
		Slightly	0.25
		Not at all	0
		Missing	-
15. Physical health resulted in accomplishing less	During the past 4 weeks, how much of the time have you had any of the following problems with your work	All of the time	1
		Most of the time	0.75
		Some of the time	0.5

DAI Construct	SJLIFE ITEM[1]	Value/Criteria	DAI Item Weight
	or other regular daily activities as a result of your physical health? B: Accomplished less than you would like	A little of the time	0.25
		None of the time	0
		Missing	-
16. Emotional problems resulted in accomplishing less	During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems? B: Accomplished less than you would like.	All of the time	1
		Most of the time	0.75
		Some of the time	0.5
		A little of the time	0.25
		None of the time	0
		Missing	-
17. Had a lot of energy	How much of the time during the past four weeks did you have a lot of energy?	All of the time	0
		Most of the time	0.25
		Some of the time	0.5
		A little of the time	0.75
		None of the time	1
		Missing	-
18. Felt downhearted or blue	How much of the time during the past four weeks have you felt downhearted and depressed?	All of the time	1
		Most of the time	0.75
		Some of the time	0.5
		A little of the time	0.25
		None of the time	0
		Missing	-
19. Felt calm or peaceful	How much of the time during the past four weeks have you felt calm and peaceful?	All of the time	0
		Most of the time	0.25
		Some of the time	0.5
		A little of the time	0.75
		None of the time	1
		Missing	-
20. Heart disease	Clinically assessed and modified CTCAE[2] graded cardiovascular conditions - Atrioventricular heart block - Conduction abnormalities - Prolonged QT interval - Cardiac dysrhythmia - Sinus bradycardia - Sinus tachycardia - Cardiomyopathy - Right ventricular systolic dysfunction - Cor pulmonale - Pulmonary hypertension	≥ 1 grade 3 or 4 condition	1
		≥ 1 grade 2 condition (but no grade 3 or 4)	0.5
		None or only grade 1 conditions	0
		Missing	-

DAI Construct	SJLIFE ITEM[1]	Value/Criteria	DAI Item Weight
	- Heart valve disorder - Pericarditis - Aortic root aneurysm - Atrial myxoma - Thrombus - Vascular disease - Hypertriglyceridemia - Hypercholesterolemia - Myocardial infarction - Raynaud's phenomenon		
21. Diabetes	Clinically assessed and modified CTCAE[2] graded abnormal glucose metabolism	≥ 1 grade 3 or 4 condition	1
		≥ 1 grade 2 condition (but no grade 3 or 4)	0.5
		None or only grade 1 conditions	0
		Missing	-
22. Respiratory	Clinically assessed and modified CTCAE[2] graded respiratory conditions - Asthma - Chronic obstructive Pulmonary disease - Obstructive, restrictive, diffusion deficits - Pleural space disorders - Pulmonary embolism - Obstructive sleep apnea	≥ 1 grade 3 or 4 condition	1
		≥ 1 grade 2 Condition (but no grade 3 or 4)	0.5
		None or only grade 1 conditions	0
		Missing	-
23. Chronic liver, kidney, or gastrointestinal	Clinically assessed and modified CTCAE[2] graded gastrointestinal/renal conditions - Constipation - Cholecystitis - Chronic kidney disease - Chronic hematuria - Dysphagia - Esophageal stricture - Esophageal varices - Esophagitis - Enterocolitis - Fecal incontinence - Gastritis/Duodenitis	≥ 1 grade 3 or 4 condition	1
		≥ 1 grade 2 condition (but no grade 3 or 4)	0.5
		None or only grade 1 conditions	0
		Missing	-

DAI Construct	SJLIFE ITEM[1]	Value/Criteria	DAI Item Weight
	- Gastroesophageal reflux Disease - Hepatopathy - Hepatic failure - Pancreatitis - Pancreatic insufficiency - Fibrosis/Cirrhosis - Portal hypertension - Proctitis - Steatohepatitis - Veno-occlusive disease of liver - Urinary bladder dysfunction - Urinary tract calculi		
24. Other cancer	Subsequent malignancies excluding "non melanoma skin cancer"	≥ 1 grade 3 or 4 condition	1
		≥ 1 grade 2 condition (but no grade 3 or 4)	0.5
		None or only grade 1 conditions	0
		Missing	-
25. Glaucoma, cataracts, or decreased vision	Have you ever been told by a doctor or other heath are professional you have or have had legal blindness, problems with double vision, or other eye problems? Clinically assessed and modified CTCAE[2] graded ocular conditions - Cataract - Glaucoma	≥ 1 grade 3 or 4 condition	1
		≥ 1 grade 2 condition (but no grade 3 or 4)	0.5
		None or only grade 1 conditions	0
		Missing	-
26. Blood pressure	Clinically assessed and modified CTCAE[2] graded hypertension	≥ 1 Grade 3 or 4 condition	1
		≥ 1 Grade 2 condition (but no grade 3 or 4)	0.5
		None or only grade 1 conditions	0
		Missing	-
27. Cerebrovascular disease	Clinically assessed and CTCAE[2] graded neurologic conditions - Cerebrovascular disease - Intracranial hemorrhage	≥ 1 grade 3 or 4 condition	1
		≥ 1 grade 2 condition (but no grade 3 or 4)	0.5

DAI Construct	SJLIFE ITEM[1]	Value/Criteria	DAI Item Weight
	- Cerebrovascular accident	None or only grade 1 conditions	0
		Missing	-
28. Osteoporosis	Clinically assessed and CTCAE[2] graded bone mineral density: BMD below expected range for age and sex (adjusted for amputation)	≥ 1 grade 3 or 4 condition	1
		≥ 1 grade 2 condition (but no grade 3 or 4)	0.5
		None or only grade 1 conditions	0
		Missing	-
29. Thyroid disease	Clinically assessed and CTCAE[2] graded endocrine conditions: - Hypothyroidism - Hyperthyroidism - Thyroid cyst/nodule - Hypoparathyroidism - Hyperparathyroidism	≥ 1 grade 3 or 4 condition	1
		≥ 1 grade 2 condition (but no grade 3 or 4)	0.5
		None or only grade 1 conditions	0
		Missing	-
30. Shingles or other chronic infections	Have you ever had Zoster (shingles)? And do you take chronic medications because of shingles? Clinically assessed and CTCAE[2] graded - Immunodeficiency - Chronic hepatitis - HIV infection	Any grade 3 or higher condition or any "yes, and the condition is still present" (for questionnaire)	1
		Any grade 2 or higher condition or any "yes, and the condition is still present" (for questionnaire)	0.5
		No grade 2 or higher condition and no or yes, but the condition is no longer present (for questionnaire)	0
		Missing	-
32. Weight/BMI	Self-reported current weight and height	Obese BMI >=30	1
		Underweight BMI <18.5	1
		Normal/overweight BMI >=18.5 and <30	0
		Missing	-
33. Polypharmacy	Self-reported medications taken regularly during the last two years	>= 5 Prescription meds	1
		<5 Prescription meds	0
		Missing	-
	Timed up and go	>6 seconds	1

DAI Construct	SJLIFE ITEM[1]	Value/Criteria	DAI Item Weight
34. Timed Up and Go		<=6 seconds	0
		Missing	-
35. Depression	Brief symptom inventory depression subscale	T-Score <=65	0
		65> T-score <=70	0.5
		T-score >70	1
		Missing	-
36. Anxiety	Brief symptom inventory anxiety subscale	T-Score <=65	0
		65> T-score <=70	0.5
		T-score >70	1
		Missing	-
37. Fatigue	Vitality subscale of short-form health survey-36	T-Score <10th percentile	1
		T-Score >=10th percentile	0
		Missing	-
38. Balance problems	Have you ever been told by a doctor or other heath are professional you have or have had problems with balance, equilibrium or ability to reach for or manipulate objects?	Any "yes, and the condition is still present"	1
		No or yes, but the condition is no longer present, not sure	0
		Missing	-
39. Hearing problems	Have you ever been told by a doctor or other heath are professional you have or have had hearing loss requiring hearing aid, deafness, tinnitus?	Any "yes, and the condition is still present"	1
		No or yes, but the condition is no longer present	0
		Missing	-
40. Smell and taste problems	Have you ever been told by a doctor or other heath are professional you have or have had abnormal sense of taste or loss of taste or smell lasting for 3 months or more?	Any "yes, and the condition is still present"	1
		No or yes, but the condition is no longer present	0
		Missing	-
41.Weakness	Have you ever been told by a doctor or other heath are professional you have or have had weakness or inability to move arms or legs?	Yes, and the conditions is still present	1
		No or yes, but the condition is longer present	0
		Missing	-
42.Loss of sense of touch	Have you ever been told by a doctor or other heath are	Yes, and the conditions is still present	1

DAI Construct	SJLIFE ITEM[1]	Value/Criteria	DAI Item Weight
	professional you have or have had decreased sense of touch or feeling in hands, fingers, arms or legs	No or yes but the condition is longer present	0
		Missing	-
43.Problems chewing and swallowing	Have you ever been told by a doctor or other heath are professional you have or have had problems chewing or swallowing solids or liquids?	Yes, and the conditions is still present	1
		No or yes but the condition is longer present	0
		Missing	-
44. Vigorous activity	Does your health now limit you in vigorous activities, such as running, lifting heavy objects, participating in strenuous sports?	Yes, limited a lot	1
		Yes, limited a little	0.5
		No, not limited at all	0
		Missing	-
44. Arthritis	Clinically assessed and CTCAE[2] graded: - Arthritis - Arthralgia	≥ 1 grade 3 or 4 condition	1
		≥ 1 grade 2 condition (but no grade 3 or 4)	0.5
		None or only grade 1 conditions	0
		Missing	-

DAI: Deficit Accumulation Index; SJLIFE: St. Jude Lifetime Cohort; CTCAE: a modified version of NCI's Common Terminology and Criteria for Adverse Events; BMI: body mass index.
[1] Item from SJLIFE questionnaire or clinical exam. Includes clinically ascertained chronic health conditions graded according to a modified version of the NCI's Common Terminology and Criteria for Adverse Events.
[2]Hudson MM, Ehrhardt MJ, Bhakta N, Baassiri M, Eissa H, Chemaitilly W, Green DM, Mulrooney DA, Armstrong GT, Brinkman TM, Klosky JL. Approach for classification and severity grading of long-term and late-onset health events among childhood cancer survivors in the St. Jude Lifetime Cohort. Cancer Epidemiology, Biomarkers & Prevention. 2017 May 1;26(5):666-74.

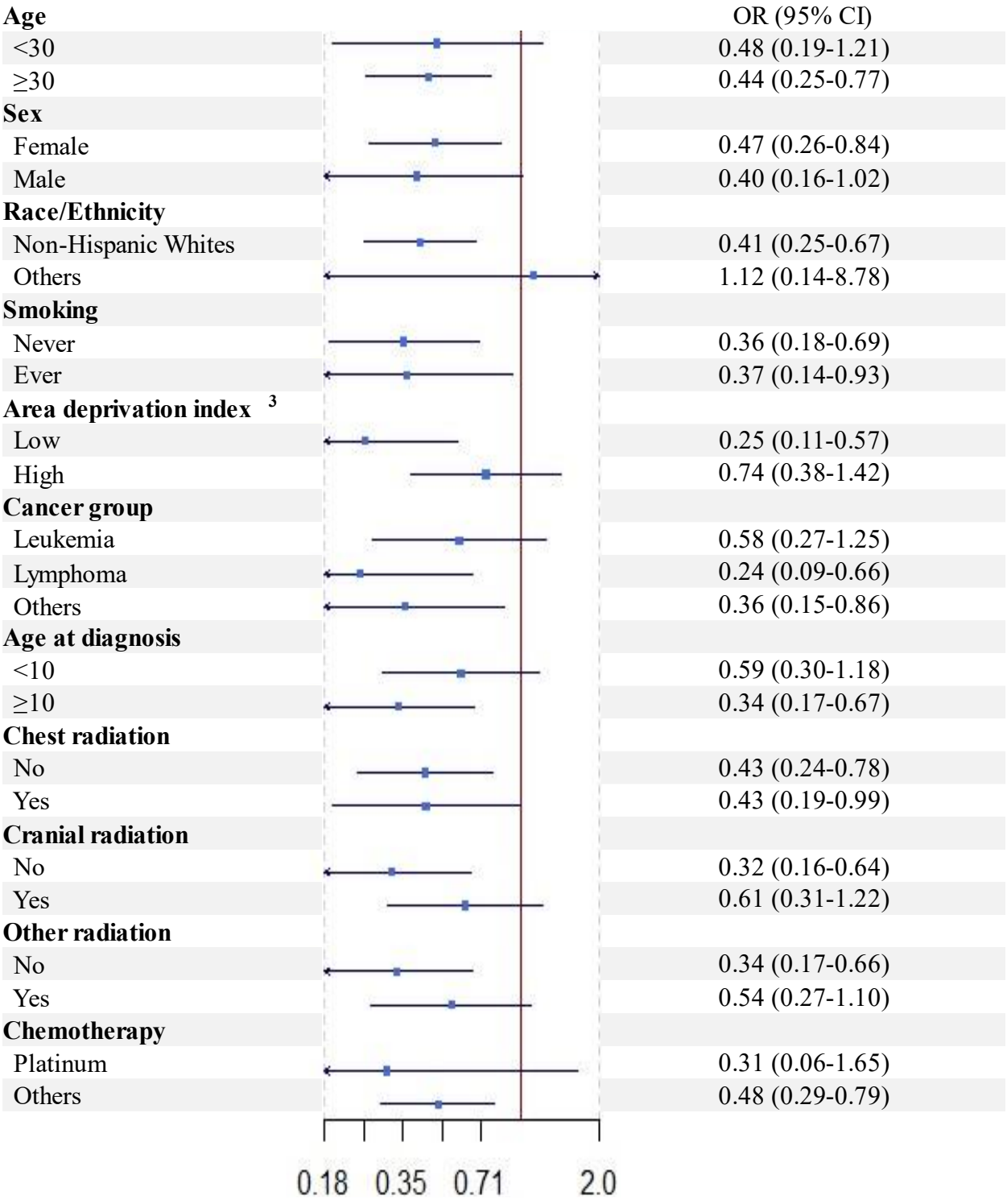
Table S3. Age adjusted odds ratios and 95% confidence intervals of deficit accumulation index (DAI) categories by dietary patterns in the St. Jude Lifetime Cohort Study

	Plant-based	Fast-food	Western contemporary	Animal-based
Low DAI (n=2,078)	1.00 (Ref.)			
Medium DAI (n=581)	1.00	1.41 (1.09-1.83)	1.26 (0.96-1.66)	1.75 (1.27-2.41)
High DAI (n=245)	1.00	2.38 (1.53-3.70)	2.90 (1.86-4.52)	2.43 (1.42-4.17)
Low DAI (n=2,078)		1.00 (Ref.)		
Medium DAI (n=581)	0.71 (0.55-0.92)	1.00	0.89 (0.71-1.13)	1.24 (0.94-1.64)
High DAI (n=245)	0.42 (0.27-0.65)	1.00	1.22 (0.89-1.67)	1.02 (0.66-1.58)
Low DAI (n=2,078)			1.00 (Ref.)	
Medium DAI (n=581)	0.79 (0.60-1.05)	1.12 (0.89-1.42)	1.00	1.39 (1.03-1.87)
High DAI (n=245)	0.35 (0.22-0.54)	0.82 (0.60-1.13)	1.00	0.84 (0.54-1.31)
Low DAI (n=2,078)				1.00 (Ref.)
Medium DAI (n=581)	0.57 (0.42-0.79)	0.81 (0.61-1.07)	0.72 (0.54-0.97)	1.00
High DAI (n=245)	0.41 (0.24-0.71)	0.98 (0.63-1.52)	1.19 (0.77-1.86)	1.00

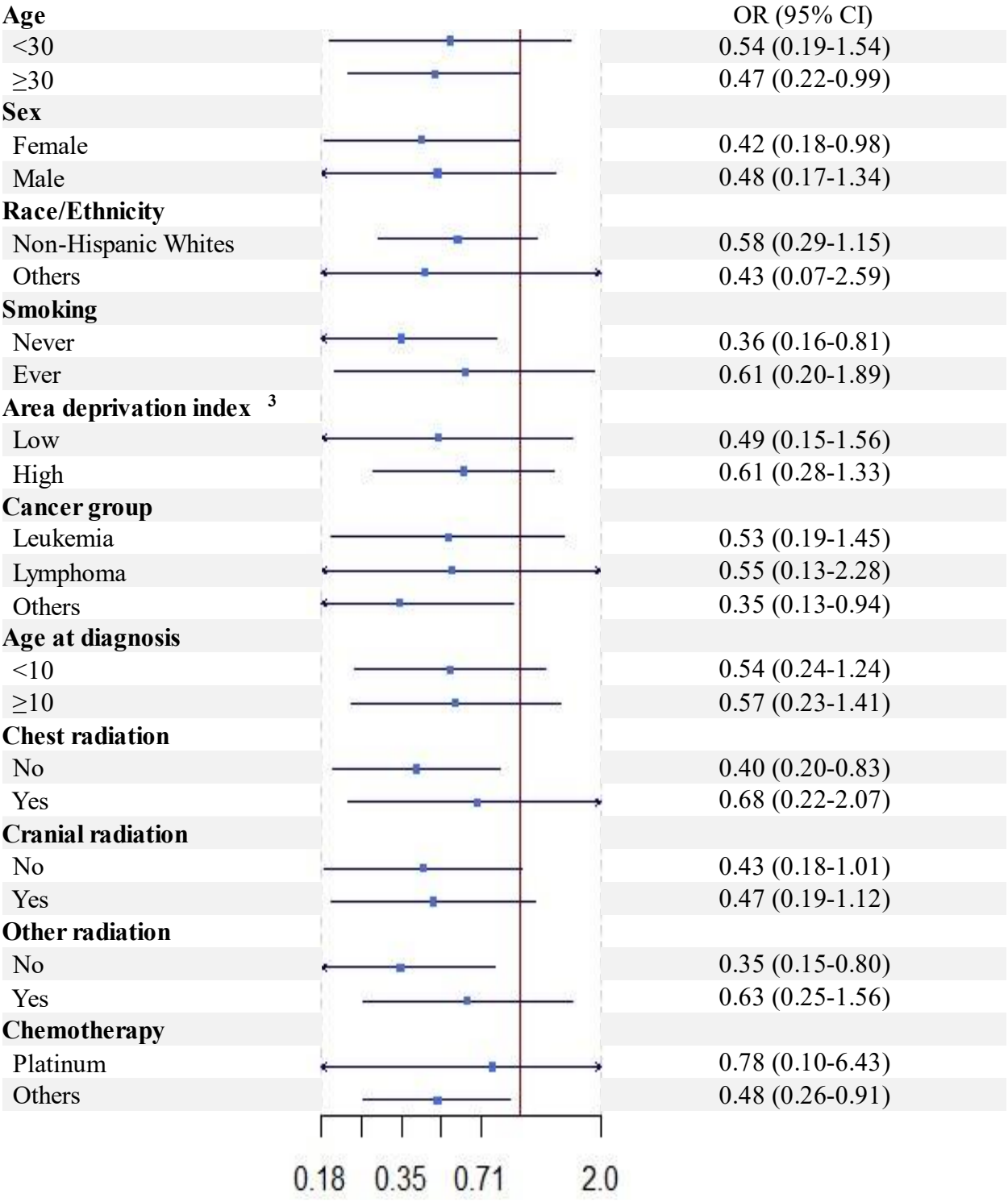
Figure S1. Multivariable adjusted[1] odds ratios and 95% confidence intervals of high deficit accumulation index (DAI) vs. low DAI[2] for consuming plant-based die compared to Western contemporary, animal-based, and fast-food diets in subgroups of adult survivors of childhood cancer: St. Jude Lifetime Cohort Study.

1. Multivariable models were adjusted for followings except for the stratification variable: age, sex (female and male), race/ethnicity (non-Hispanic White, non-Hispanic Black, and Hispanic or other), education (less than high school, high school graduation, training after high school, and college or post-grad, and unknown), area deprivation index (quartiles and unknown), smoking (never, former, current, and unknown), multivitamin use (yes and no), single supplement use (yes and no), cancer treatments - platinum-based chemotherapy, other chemotherapy, chest radiation, cranial radiation, other radiation (yes and no).
2. Deficit Accumulation Index (DAI) was assessed based on 44 aging-related health conditions and grouped into low (<0.2), medium (0.2 - <0.35), and high (≥ 0.35) deficit accumulation categories.
3. Area deprivation index: low was defined as below median and high was above median)
4. Squares in figures indicate the log odds ratios, errors bars of the squares indicate the 95% CIs, and arrows indicate the 95% CIs exceed the specified x axis limits.

A. Plant-based diet vs. Western contemporary diet



B. Plant-based diet vs. Animal-based diet



C. Plant-based diet vs. Fast-food diet