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# Is the frequency of breakfast consumption associated with life satisfaction in children and adolescents? A cross-sectional study with 154,151 participants from 42 countries

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## Abstract

**Background** The promotion of daily breakfast consumption and the importance of making appropriate breakfast choices have been underscored as significant public health messages. The aim of this study was to examine the relationship between breakfast frequency and life satisfaction in large and representative samples of school-going children and adolescents aged 10–17 years from 42 different countries.

**Methods** This study used information from the 2017/2018 Health Behavior in School-aged Children study, comprising nationally representative samples of children and adolescents aged 10–17 years who were attending school. The total number of participants from the 42 countries included in the study was 155,451 (51.3% girls). The evaluation of breakfast consumption in this study involved a specific question: “How often do you typically have breakfast (more than a glass of milk or fruit juice)?”. To measure life satisfaction, a subjective assessment scale was used in the form of a ladder, visually spanning from 0 to 10. On this scale, the topmost point (10) denotes the highest conceivable quality of life, whereas the bottom point (0) represents the worst imaginable quality of life.

**Results** After adjusting for several covariates, the lowest estimated marginal mean of life satisfaction was identified in those participants who skipped breakfast (mean [M] = 5.6, 95% confidence interval [CI] 5.5 to 5.8). Conversely, the highest estimated marginal mean of life satisfaction was observed in those who had breakfast every day (M = 6.5, 95% CI 6.3 to 6.6). Overall, a nearly linear relationship between higher frequency of breakfast and greater life satisfaction in children and adolescents was identified ( $p$ -for-trend < 0.001). In addition, the highest estimated marginal mean of life satisfaction score was identified in those participants from Portugal who had breakfast every day (M = 7.7; 95% CI 6.9 to 8.5 points). Conversely, the lowest estimated marginal mean of life satisfaction was observed in those participants from Romania who no breakfast (M = 3.5; 95% CI 2.6 to 4.4 points).

**Conclusions** There is a nearly linear relationship between higher frequency of breakfast and greater life satisfaction in children and adolescents. Considering the potential health advantages associated with breakfast during this

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critical age phase, these findings imply the necessity for additional global efforts to promote increased breakfast consumption among children and adolescents.

**Keywords** Eating healthy, Well-being, Mental health, Youth, Adolescence, Childhood

## Introduction

Life satisfaction is commonly defined as an individual's cognitive and emotional assessment of their own life [1]. While extensive research has been conducted on this topic among adults, comparatively less focus has been placed on children and adolescents [2, 3]. However, there is a growing interest in understanding subjective well-being, including life satisfaction, among children and adolescents because of the significant changes that occur during this critical period [4, 5]. Some studies have suggested a notable decline in well-being during adolescence [4, 6–8], which is attributed to associated biological and psychosocial changes [9]. Therefore, at the public health level, it is essential to identify the factors that positively influence life satisfaction, a crucial cognitive aspect of hedonic subjective well-being [10]. Adolescent well-being is significant for both personal and societal reasons, given that adolescence is a pivotal life stage in which crucial elements contributing to lifelong well-being are either established or neglected [11]. Consequently, recognizing these factors is particularly important given the potential impact of adolescent well-being on later adult mental health [12].

While there is a general consensus in academic circles that child and adolescent well-being is a complex concept with multiple dimensions [13], scientific literature emphasizes the significance of lifestyle as a crucial factor [14–20]. Numerous studies have established a connection between overall diet and well-being [15, 16], with diet quality being linked to life satisfaction among young individuals [19]. For instance, a study involving Chilean children found that higher adherence to the Mediterranean diet was associated with increased life satisfaction [19]. Another relevant aspect of adolescence is the habit of consuming breakfast [16, 21–24]. Regularly having a nutritious breakfast has been associated with numerous positive effects on psychosocial and health-related behaviors, including enhanced memory recall, improved cognitive function, and increased levels of physical activity, among other benefits [21, 24, 25]. Conversely, a meta-analysis found that skipping breakfast was positively associated with the odds of depression, stress, and psychological distress in all age groups and anxiety in adolescence, underlining the role of breakfast on mental health [16]. Despite this, the association of breakfast frequency with adolescents' perceived life satisfaction has been relatively underexplored [26, 27]. In the context of adolescence, breakfast quality plays a crucial role in the interplay between lifestyle and psychosocial health

during early adolescence [24, 28]. Recommendations suggest that a healthy breakfast should encompass a variety of foods from different food groups, such as fruits, vegetables, whole grains, lean protein, and healthy fats, while avoiding sugary cereals and processed foods [29]. There is also a preference for the consumption of whole fruits over fruit juices due to more conclusive evidence regarding the health benefits of whole fruits [30]. Consequently, the promotion of daily breakfast consumption and the importance of making appropriate breakfast choices have been underscored as significant public health messages [31]. Despite this, it is noteworthy that many adolescents tend to skip breakfast, and the prevalence of children and adolescents skipping this important meal is increasing [32–34]. Given these considerations, the aim of this study was to examine the relationship between breakfast frequency and life satisfaction in large and representative samples of school-going children and adolescents aged 10–17 years from 42 different countries.

## Methods

### Study design and population

This cross-sectional study included data from 42 countries, including Albania, Armenia, Austria, Azerbaijan, Belgium (Flanders and Wallonia), Bulgaria, Canada, Croatia, the Czech Republic, Denmark, England, Estonia, Finland, France, Georgia, Germany, Greece, Greenland, Hungary, Iceland, Israel, Italy, Kazakhstan, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, North Macedonia, Norway, Poland, Portugal, the Republic of Moldova, Romania, the Russian Federation, Scotland, Serbia, Slovenia, Spain, Sweden, Ukraine, and Wales. This study used information from the 2017/2018 Health Behavior in School-aged Children (HBSC) study [35], comprising nationally representative samples of children and adolescents aged 10–17 years who were attending school. Slovakia was removed because of missing information on frequency of breakfast consumption (independent variable). Ireland and Switzerland were excluded from the analysis due to insufficient information on frequency of family meals (covariate). The total number of participants from the 42 countries included in the study was 155,451 (51.3% girls). The selection of children and adolescents for the study involved a random sampling method from various schools. The participants completed a standardized test anonymously (i.e., self-reported), and the assessment was conducted in their native language. Students had the option to decline answering specific questions. Each participating

country obtained institutional ethics approval and written informed consent forms were signed by the schools, children, adolescents, and their parents or legal guardians. Notably, because the present study entailed a secondary analysis of anonymized data, formal approval from an ethics committee was deemed unnecessary.

## Procedures

### **Frequency of breakfast consumption (independent variable)**

The evaluation of breakfast consumption in this study involved a specific question: “How often do you typically have breakfast (more than a glass of milk or fruit juice)?” [35]. Participants were asked to respond to this question separately for weekdays, with response options ranging from 0 to 5 days, and weekends, with options ranging from 0 to 2 days. The total frequency of breakfast consumption by the children and adolescents was calculated by summing the number of days they reported having breakfast.

### **Life satisfaction (dependent variable)**

To measure life satisfaction, a subjective assessment scale was used in the form of a ladder, visually spanning from 0 to 10 [36]. On this scale, the topmost point (10) denotes the highest conceivable quality of life, whereas the bottom point (0) represents the worst imaginable quality of life. Participants were directed to place an “X” adjacent to the number that most accurately reflected their present position on the life satisfaction scale. This visual method offered a graphic representation of the participants’ self-assessments of their current level of life satisfaction.

### **Covariates**

The children and adolescents in this study provided self-reported information regarding their age and sex. The Family Affluence Scale (FAS-III) was employed to assess the socioeconomic status (SES), consisting of six questions with responses ranging from 0 to 13 points [37]. Total scores obtained by summing individual responses reflected a higher SES with a higher score. The FAS-III covered various aspects of family material assets, including the number of bathrooms, cars, non-shared bedrooms, dishwashers, computers, and foreign vacations taken in the last 12 months. *Ridit* scores, specific to age groups and sex, were calculated for each participating country according to international standards [38]. These *ridit* scores categorized children and adolescents into three SES groups: bottom 20% (low SES), middle 60% (medium SES), and top 20% (high SES). The frequency of different eating habits was determined through questions such as “How many times a week do you eat fruits/vegetables/sweets/soft drinks?” with response options ranging from never to more than once per day. The frequency of family meals was assessed using the question:

“How often do you and your family typically have meals together?” with response options including “every day”, “most days”, “approximately once a week”, “less often”, and “never”. Physical activity was evaluated with the question “In a typical or usual week, how many days do you engage in physical activity for at least 60 minutes a day?” with responses ranging from 0 to 7 days per week. Finally, children and adolescents self-reported their body weight and height, which were then used to calculate their body mass index ( $\text{kg}/\text{m}^2$ ). The selection of the covariates included was based in the scientific literature [26, 39, 40].

### **Statistical analysis**

The data in this study are presented as counts and percentages for categorical variables and as means and standard deviations for continuous variables. Generalized linear mixed models were employed to investigate the relationship between the frequency of breakfast consumption (as a fixed effect), country (as a random effect), and life satisfaction (as the outcome). The data were weighted by expansion factors to ensure the representativeness of the country. Furthermore, these associations were further adjusted for various covariates, including sex, age group, SES, fruit consumption, vegetable consumption, soft drink consumption, sweet consumption, frequency of family meals, physical activity, and body mass index. To determine, how much variability there is between individuals across all countries, the intra-class correlation coefficient was computed. Additionally, estimated marginal means of life satisfaction and their 95% confidence intervals (CIs) were calculated based on the frequency of breakfast consumption. As a sensitivity analysis and to observe the consistency of the results regardless of the country examined, the estimated marginal means of life satisfaction (adjusted for the same covariates) of the two extremes of breakfast frequency (i.e., 0 days versus 7 days) were shown. Furthermore, to address potential bias stemming from incomplete data, a sensitivity analysis using multiple imputation techniques was applied, assuming that missing data occurred randomly. The *mice* package was used to replace missing values through chained equations [41]. To ensure robustness, 36 datasets were created with multiple imputations, in line with recommendations to set the number of imputations to be more than 100 times the highest proportion of missing information (i.e., 36.0%) [42].

## Results

Table 1 shows the descriptive data of the participants according to the frequency of breakfast consumption by the listwise deletion method. Overall, the life satisfaction mean was  $7.8 \pm 1.9$  points. Regarding the frequency of breakfast consumption, participants who skipped breakfast (i.e., 0 times per week) showed the lowest mean life

**Table 1** Descriptive data of the study participants according to frequency of breakfast consumption by listwise deletion method. (N = 154,151)

Variables	Frequency of breakfast consumption (days)								Total	
	0	1	2	3	4	5	6	7		
Age	Mean (SD)	14.1 (1.6)	13.8 (1.6)	13.7 (1.6)	13.7 (1.6)	13.7 (1.6)	13.6 (1.6)	13.4 (1.7)	13.6 (1.7)	
Age group	Aged 10–12 years	879 (15.9)	1197 (16.8)	3858 (21.7)	1846 (24.0)	2102 (23.8)	3032 (23.7)	3655 (26.0)	25,154 (31.1)	41,723 (27.0)
	Aged 13–15 years	2031 (36.8)	2850 (40.1)	7176 (40.3)	3070 (40.0)	3734 (42.3)	5153 (40.2)	5737 (40.8)	32,519 (40.2)	62,271 (40.3)
	Aged 16–17 years	2605 (47.2)	3066 (43.1)	6761 (38.0)	2766 (36.0)	2993 (33.9)	4622 (36.1)	4685 (33.3)	23,184 (28.7)	50,681 (32.8)
Sex	Boys (%)	2599 (47.1)	2935 (41.3)	7558 (42.5)	3487 (45.4)	4082 (46.2)	6237 (48.7)	7130 (50.7)	41,297 (51.1)	75,327 (48.7)
	Girls (%)	2916 (52.9)	4178 (58.7)	10,237 (57.5)	4195 (54.6)	4746 (53.8)	6570 (51.3)	6947 (49.3)	39,560 (48.9)	79,349 (51.3)
SES	Low SES (%)	1400 (25.4)	1626 (22.9)	3765 (21.2)	1650 (21.5)	1810 (20.5)	2485 (19.4)	2550 (18.1)	12,962 (16.0)	28,249 (18.3)
	Medium SES (%)	3260 (59.1)	4338 (61.0)	10,991 (61.8)	4772 (62.1)	5401 (61.2)	8042 (62.8)	8706 (61.8)	50,584 (62.6)	96,093 (62.1)
	High SES (%)	855 (15.5)	1149 (16.2)	3039 (17.1)	1260 (16.4)	1618 (18.3)	2280 (17.8)	2822 (20.0)	17,311 (21.4)	30,334 (19.6)
Fruits consumption	Never (%)	373 (6.8)	291 (4.1)	525 (3.0)	281 (3.7)	213 (2.4)	360 (2.8)	325 (2.3)	1680 (2.1)	4049 (2.6)
	Less once a week (%)	648 (11.7)	805 (11.3)	1271 (7.1)	530 (6.9)	536 (6.1)	813 (6.4)	786 (5.6)	3736 (4.6)	9126 (5.9)
	Once a week (%)	695 (12.6)	925 (13.0)	1989 (11.2)	880 (11.5)	939 (10.6)	1156 (9.0)	1316 (9.4)	6190 (7.7)	14,090 (9.1)
	2–4 days a week (%)	1348 (24.4)	1994 (28.0)	4862 (27.3)	2153 (28.0)	2662 (30.2)	3691 (28.8)	3898 (27.7)	19,112 (23.6)	39,721 (25.7)
	5–6 days a week (%)	708 (12.8)	954 (13.4)	2664 (15.0)	1138 (14.8)	1473 (16.7)	2144 (16.7)	2497 (17.7)	13,213 (16.3)	24,790 (16.0)
	Once daily (%)	704 (12.8)	991 (13.9)	2903 (16.3)	1192 (15.5)	1350 (15.3)	2123 (16.6)	2454 (17.4)	15,787 (19.5)	27,503 (17.8)
Vegetables consumption	More than once daily (%)	1040 (18.9)	1152 (16.2)	3580 (20.1)	1509 (19.6)	1654 (18.7)	2521 (19.7)	2801 (19.9)	21,140 (26.1)	35,398 (22.9)
	Never (%)	523 (9.5)	480 (6.7)	890 (5.0)	385 (5.0)	379 (4.3)	514 (4.0)	497 (3.5)	2514 (3.1)	6182 (4.0)
	Less once a week (%)	625 (11.3)	652 (9.2)	1319 (7.4)	615 (8.0)	615 (7.0)	780 (6.1)	771 (5.5)	3607 (4.5)	8983 (5.8)
	Once a week (%)	667 (12.1)	904 (12.7)	2018 (11.3)	926 (12.1)	1053 (11.9)	1323 (10.3)	1323 (9.4)	6148 (7.6)	14,361 (9.3)
	2–4 days a week (%)	1222 (22.2)	1830 (25.7)	4326 (24.3)	1899 (24.7)	2355 (26.7)	3281 (25.6)	3465 (24.6)	17,389 (21.5)	35,766 (23.1)
	5–6 days a week (%)	814 (14.8)	1187 (16.7)	3235 (18.2)	1292 (16.8)	1661 (18.8)	2537 (19.8)	2949 (20.9)	15,654 (19.4)	29,328 (19.0)
Soft drinks consumption	Once daily (%)	768 (13.9)	1093 (15.4)	3226 (18.1)	1323 (17.2)	1477 (16.7)	2373 (18.5)	2789 (19.8)	17,440 (21.6)	30,488 (19.7)
	More than once daily (%)	896 (16.3)	969 (13.6)	2781 (15.6)	1243 (16.2)	1290 (14.6)	1999 (15.6)	2284 (16.2)	18,106 (22.4)	29,567 (19.1)
	Never (%)	813 (14.7)	864 (12.1)	2204 (12.4)	1075 (14.0)	1096 (12.4)	1549 (12.1)	1913 (13.6)	12,733 (15.7)	22,246 (14.4)
	Less once a week (%)	1078 (19.6)	1441 (20.3)	3859 (21.7)	1754 (22.8)	1998 (22.6)	3038 (23.7)	3456 (24.5)	21,625 (26.7)	38,250 (24.7)
	Once a week (%)	783 (14.2)	1266 (17.8)	3145 (17.7)	1450 (18.9)	1722 (19.5)	2494 (19.5)	2790 (19.8)	16,180 (20.0)	29,831 (19.3)
	2–4 days a week (%)	937 (17.0)	1451 (20.4)	3597 (20.2)	1475 (19.2)	1831 (20.7)	2658 (20.8)	2834 (20.1)	14,872 (18.4)	29,656 (19.2)
Sweets consumption	5–6 days a week (%)	513 (9.3)	669 (9.4)	1533 (8.6)	649 (8.4)	792 (9.0)	1141 (8.9)	1216 (8.6)	5452 (6.7)	11,966 (7.7)
	Once daily (%)	496 (9.0)	558 (7.8)	1475 (8.3)	573 (7.5)	625 (7.1)	878 (6.9)	888 (6.3)	4415 (5.5)	9908 (6.4)
	More than once daily (%)	895 (16.2)	865 (12.2)	1982 (11.1)	706 (9.2)	765 (8.7)	1047 (8.2)	981 (7.0)	5579 (6.9)	12,819 (8.3)
	Never (%)	384 (7.0)	313 (4.4)	697 (3.9)	370 (4.8)	354 (4.0)	446 (3.5)	512 (3.6)	3059 (3.8)	6134 (4.0)
	Less once a week (%)	844 (15.3)	979 (13.8)	2201 (12.4)	990 (12.9)	1128 (12.8)	1527 (11.9)	1682 (11.9)	10,197 (12.6)	19,547 (12.6)
	Once a week (%)	875 (15.9)	1232 (17.3)	2981 (16.8)	1395 (18.2)	1571 (17.8)	2362 (18.4)	2762 (19.6)	15,135 (18.7)	28,314 (18.3)
Family meals	2–4 days a week (%)	1378 (25.0)	1826 (25.7)	4698 (26.4)	1968 (25.6)	2582 (29.2)	3822 (29.8)	4139 (29.4)	22,471 (27.8)	42,884 (27.7)
	5–6 days a week (%)	569 (10.3)	928 (13.0)	2324 (13.1)	1111 (14.5)	1243 (14.1)	1636 (12.8)	1866 (13.3)	10,207 (12.6)	19,884 (12.9)
	Once daily (%)	592 (10.7)	845 (11.9)	2426 (13.6)	937 (12.2)	990 (11.2)	1541 (12.0)	1687 (12.0)	10,120 (12.5)	19,139 (12.4)
	More than once daily (%)	872 (15.8)	990 (13.9)	2469 (13.9)	910 (11.8)	961 (10.9)	1473 (11.5)	1431 (10.2)	9668 (12.0)	18,774 (12.1)
	Never (%)	489 (8.9)	331 (4.6)	549 (3.1)	205 (2.7)	215 (2.4)	307 (2.4)	243 (1.7)	941 (1.2)	3280 (2.1)

**Table 1** (continued)

Variables	Frequency of breakfast consumption (days)								Total
	0	1	2	3	4	5	6	7	
Less often (%)	713 (12.9)	838 (11.8)	1554 (8.7)	616 (8.0)	692 (7.8)	887 (6.9)	834 (5.9)	3470 (4.3)	9603 (6.2)
About once a week (%)	590 (10.7)	986 (13.9)	2151 (12.1)	853 (11.1)	1029 (11.7)	1350 (10.5)	1275 (9.1)	5484 (6.8)	13,718 (8.9)
Most days (%)	1406 (25.5)	2249 (31.6)	5665 (31.8)	2514 (32.7)	3145 (35.6)	4541 (35.5)	5213 (37.0)	25,628 (31.7)	50,361 (32.6)
Every day (%)	2318 (42.0)	2710 (38.1)	7877 (44.3)	3494 (45.5)	3747 (42.4)	5722 (44.7)	6513 (46.3)	45,333 (56.1)	77,714 (50.2)
Weekly physical activity (days) <sup>†</sup>	3.6 (2.3)	3.6 (2.1)	3.8 (2.1)	3.8 (2.1)	3.9 (2.0)	4.0 (2.0)	4.1 (2.0)	4.3 (2.0)	5.1 (2.1)
Body mass index (kg/m <sup>2</sup> )	20.5 (4.0)	20.6 (3.9)	20.2 (3.7)	20.0 (3.8)	19.9 (3.7)	19.9 (3.7)	19.6 (3.5)	19.1 (3.4)	19.6 (3.6)
Life satisfaction (score)	6.9 (2.4)	7.0 (2.2)	7.5 (2.0)	7.5 (2.0)	7.5 (1.9)	7.6 (1.9)	7.7 (1.8)	8.1 (1.7)	7.8 (1.9)

SD standard deviation, SES socioeconomic status. <sup>†</sup>At least 60 min a day

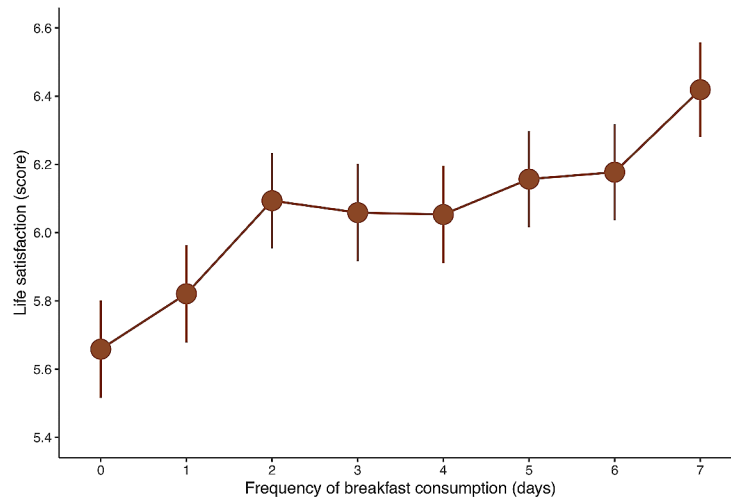
satisfaction ( $M=6.9 \pm 2.4$  points), while the highest mean was observed in those who had breakfast daily (i.e., seven times per week) ( $M=8.1 \pm 1.7$  points).

Figure 1 shows the estimated marginal means of life satisfaction according to the frequency of breakfast consumption by the listwise deletion method. The lowest estimated marginal mean of life satisfaction was identified in those participants who no breakfast (mean  $[M]=5.7$ , 95% CI 5.5 to 5.8 points). Conversely, the highest estimated marginal mean of life satisfaction was observed in those who had breakfast every day ( $M=6.4$ , 95% CI 6.3 to 6.6 points). Overall, a nearly linear relationship between higher frequency of breakfast and greater life satisfaction in children and adolescents was identified ( $p$ -for-trend  $<0.001$ ). The analysis reporting the estimated marginal means of life satisfaction according to the frequency of breakfast consumption using multiple imputations by chained methods can be found in Figure S1. Moreover, Table S1 and Table S2 display the full results of the generalized linear models assessing the association between frequency of breakfast consumption and life satisfaction by listwise deletion method or using consumption using multiple imputations by chained, respectively. Regardless of the method used to analyze the data, the results appear to be similar.

Figure 2 displays the sensitivity analysis showing the estimated marginal mean of participants' life satisfaction score for the extreme categories of the frequency of breakfast (i.e., "zero days" versus "seven days") for each country. Despite inconsistencies across countries, in all 42 countries examined, the estimated marginal mean of life satisfaction score was lower in participants who no breakfast than for those who had breakfast daily. In addition, the highest estimated marginal mean of life satisfaction score was identified in those participants from Portugal who had breakfast every day ( $M=7.7$ ; 95% CI 6.9 to 8.5 points). Conversely, the lowest estimated marginal mean of life satisfaction was observed in those participants from Romania who no breakfast ( $M=3.5$ ; 95% CI 2.6 to 4.4 points). Estimated marginal means of life satisfaction based on the full frequency of breakfast consumption for each country can be found in Table S3.

### Discussion

Overall, these findings indicated that a higher frequency of breakfast consumption is associated with greater reported life satisfaction in an almost linear relationship, based on large and representative samples of school-going children and adolescents examined. The highest life satisfaction score was identified in participants who had breakfast daily, whereas the lowest life satisfaction score was observed in those participants who never had breakfast. These results are in line with a previous study which identified several behavioral factors associated with low



Outcome	Predictor Frequency of breakfast consumption (days)							
	0	1	2	3	4	5	6	7
Life satisfaction (score)	5.7 (5.5 to 5.8)	5.8 (5.7 to 6.0) <sup>a</sup>	6.1 (6.0 to 6.2) <sup>a,b</sup>	6.1 (5.9 to 6.2) <sup>a,b</sup>	6.1 (5.9 to 6.2) <sup>a,b,c,d</sup>	6.2 (6.0 to 6.3) <sup>a,b,c,d,e</sup>	6.2 (6.0 to 6.3) <sup>a,b,c,d,e</sup>	6.4 (6.3 to 6.6) <sup>a,b,c,d,e,f,g</sup>

The data are expressed as estimated marginal means and 95% confidence intervals. Analyses were adjusted for age, sex, socioeconomic status, fruit consumption, vegetable consumption, soft drink consumption, sweet consumption, frequency of family meals, and physical activity. CI, confidence interval. <sup>a</sup> Significant difference from "0" ( $p < 0.05$ ). <sup>b</sup> Significant difference from "1" ( $p < 0.05$ ). <sup>c</sup> Significant difference from "2" ( $p < 0.05$ ). <sup>d</sup> Significant difference from "3" ( $p < 0.05$ ). <sup>e</sup> Significant difference from "4" ( $p < 0.05$ ). <sup>f</sup> Significant difference from "5" ( $p < 0.05$ ). <sup>g</sup> Significant difference from "6" ( $p < 0.05$ ).

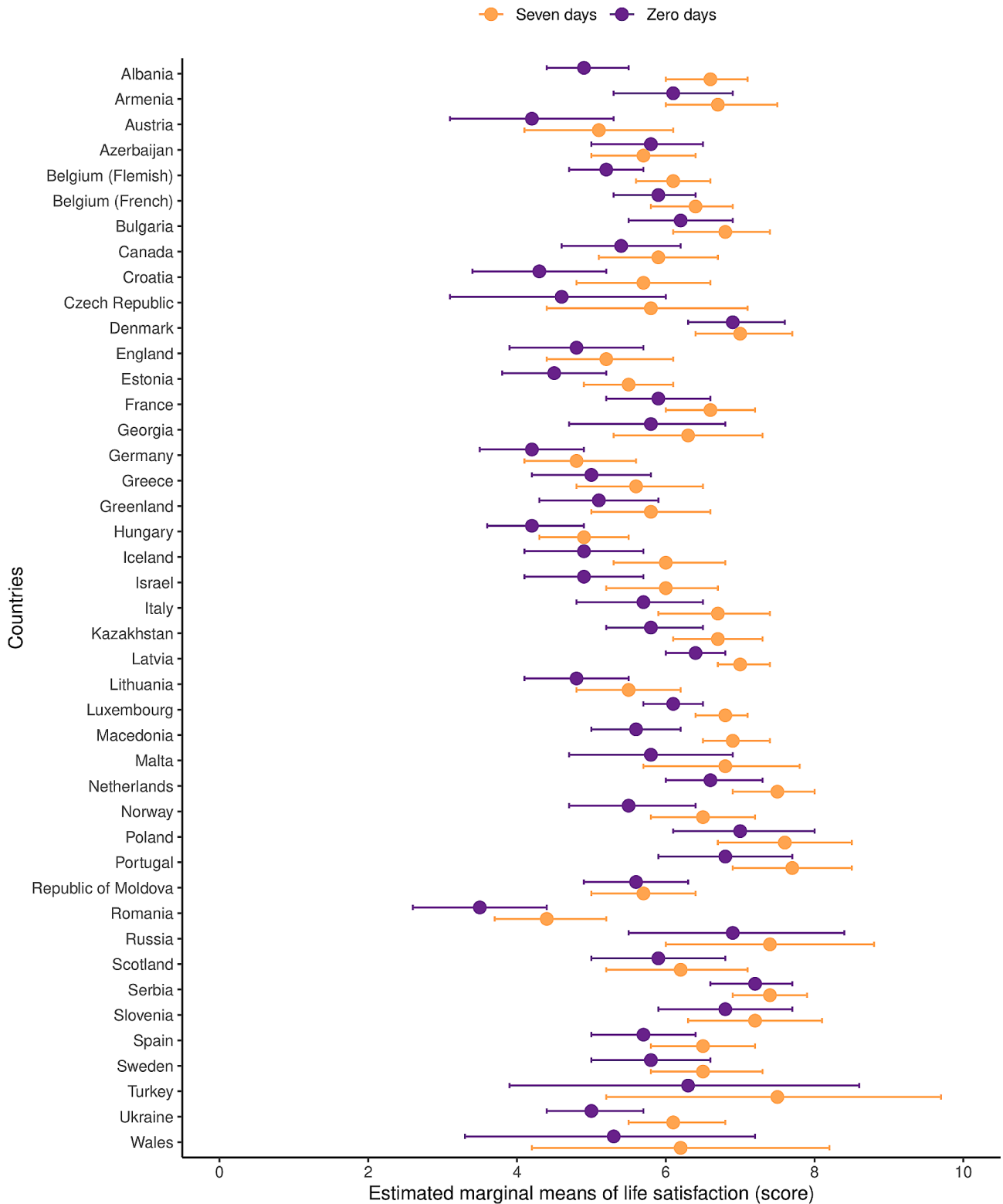
**Fig. 1** Estimated marginal means of life satisfaction based on the frequency of breakfast consumption by listwise deletion method. Data expressed as dots (means) and lines (95% confidence intervals). Adjusted for sex, age group, socioeconomic status, fruit consumption, vegetable consumption, soft drink consumption, sweet consumption, breakfast consumption, frequency of family meals, physical activity, and body mass index

life satisfaction in boys and girls, such as having breakfast less than daily [33]. Similarly, it has been identified observed that Iranian children and adolescents who had breakfast, lunch, and dinner 5–7 times per week reported significantly higher life satisfaction than did others [26]. There are several possible explanations for this finding.

First, one potential explanation for the observed findings could be the established association between the frequency of breakfast consumption and mood. The scientific literature has consistently highlighted the relationship between skipping breakfast and negative moods in adolescents [15, 16, 19, 43–45]. A meta-analysis found that skipping breakfast was associated with higher odds of having stress, depression, and psychological distress across all age groups, with a specific mention of anxiety in adolescents [16]. This notion is supported by another study which reported that Spanish adolescents with a higher percentage of breakfast skippers exhibited significantly lower health-related quality of life [15]. Furthermore, it has been observed that students who consumed breakfast daily, along with adopting other healthy habits, such as a high daily intake of fruits and vegetables and having at least three meals, reported the highest levels of happiness [43]. Another study reported an inverse relationship between the frequency of breakfast consumption and somatic symptoms (i.e., tiredness, sleep-problems, breathing, nausea, appetite, headache, fever) among

Korean children, where increased breakfast consumption was associated with decreased somatic symptoms [45]. These somatic symptoms can significantly impact an individual’s daily life, and they are often associated with somatic symptom disorder when they cause excessive and disproportionate worry and anxiety (among others) [46]. Lastly, evidence suggests that eating breakfast, especially at home, is associated with lower odds of psychosocial behavioral problems in children and adolescents [22]. These collective findings underscore the potential impact of breakfast habits on mood and psychological well-being in this population.

A second potential explanation for the observed results could be the role of essential nutrients, vitamins, and minerals from breakfast. This meal presents an opportunity for adolescents to obtain crucial nutrients required for their overall health and well-being [47, 48]. During adolescence, the intake of essential nutrients through a nutritious breakfast is particularly important, supporting growth and development during this critical stage of life [16, 49]. A systematic review with meta-analysis highlights the association between breakfast consumption and improved macronutrient intake, healthier food and beverage consumption, and overall well-being in children and adolescents [48]. A balanced diet rich in fruits, vegetables, whole grains, lean proteins, and healthy fats nurtures the well-being of adolescents [16, 50]. Given that



**Fig. 2** Estimated marginal means of life satisfaction according to the two extreme categories of frequency of breakfast (“zero days” versus “seven days”) for school-going children and adolescents aged 10–17 years by country. Adjusted for sex, age group, socioeconomic status (SES), fruit consumption, vegetable consumption, soft drink consumption, sweet consumption, breakfast consumption, frequency of family meals, physical activity, and body mass index. Information of the participants from one to six days of breakfast is not shown in this figure

breakfast can serve as a source of these essential nutrients, life satisfaction could be influenced by the nutritional content of breakfast. However, it is important to note that this hypothesis should be interpreted with caution, as the study did not specifically examine the quality of breakfast, and these essential nutrients can also be obtained from other meals, such as lunch and dinner.

On the other hand, a third possible explanation for these findings could be associated with the establishment of healthy habits and routines. Consistent consumption of breakfast may be linked to an overall healthier lifestyle [19, 51]. Adolescents who regularly eat breakfast might be more inclined to adopt other healthy behaviors such as maintaining a nutritious diet, engaging in regular physical activity, limiting screen time, and ensuring optimal sleep duration, all of which contribute to their overall well-being [14, 18, 19, 51]. Consequently, a healthy lifestyle may lead to greater life satisfaction. Moreover, incorporating breakfast into a morning routine can provide structure to an adolescent's day, potentially aiding effective time management [52]. Having a set time for breakfast encourages punctuality and organization, setting a positive tone for the remainder of the day [53]. Research emphasizes the benefits of consistent and predictable family environments for healthy development, with family routines playing a crucial role in adolescents' long-term development [54]. The establishment of routines and structures could positively impact organization and time management, thereby contributing to greater life satisfaction [55]. In this context, the routine of having breakfast could be a key element in fostering positive habits and organization, ultimately influencing children's and adolescents' life satisfaction.

Additionally, a fourth potential explanation could be related to the relationship between breakfast consumption and academic performance. Several studies have shown that regular breakfast intake improves academic performance in adolescents [20, 53, 56]. Consuming an adequate breakfast provides the necessary energy and nutrients for optimal cognitive functioning and enhances concentration, memory, and learning ability [56, 57]. Studies have also shown that breakfast consumption, compared to fasting, has a short-term positive effect on domain-specific cognition, with tasks requiring attention, executive function, and memory being more reliably facilitated by breakfast consumption [53]. Moreover, another study observed that those who reported more frequent breakfast consumption and family meals were more likely to perceive their school performance as higher than their peers [20]. There is also a recognized connection between academic performance and life satisfaction in adolescents, with some studies suggesting a positive relationship between these two variables [58, 59]. Given these findings, it is possible to hypothesize that

the habit of eating breakfast is associated with higher academic performance, which in turn contributes to increased life satisfaction in adolescents.

Our study identified inconsistencies in life satisfaction means among countries, which might be influenced by diverse cultures and lifestyles, such as various eating habits. Preferences and types of food consumed for breakfast, as well as the significance attributed to it, can differ greatly across cultures [49, 60]. These cultural variations might have contributed to the observed differences in life satisfaction outcomes. Additionally, individual differences among people within each country, including personal preferences, health conditions, and lifestyle choices, may have impacted life satisfaction scores and may not have been adequately controlled for in the study [61–63]. Furthermore, external influences like economic performance, economic crises, political instability, and public health issues can affect life satisfaction independently of breakfast habits [64–67]. For instance, higher national economic performance has been linked to greater life satisfaction [65]. However, the relationship between life satisfaction and gross domestic product differs in poor and rich countries due to increased aspirations for higher income [66]. Economic crises also seem to have a greater impact on life satisfaction in low-trust countries than in high-trust ones. Despite these possible cultural and economic factors, our results show that, in all the countries examined, reported life satisfaction is systematically higher in those who eat breakfast daily than in those who never eat breakfast, which adds robustness to these findings.

It is crucial to interpret the findings of this study while considering specific limitations. First, the cross-sectional design of the study restricted the ability to establish a causal relationship among the observed outcomes. Second, the use of self-reported information by adolescents could introduce recall bias and social desirability. However, this limitation is inherent to the use of questionnaires. Consequently, future prospective observational studies are essential to explore whether the frequency of breakfast consumption is genuinely associated with adolescent life satisfaction. Third, the use of concise questions aimed at reducing participant burden resulted in a lack of in-depth data on the variables under examination. The employment of a more detailed measure could potentially yield additional insights for each item and offer details on other aspects related to breakfast, such as its quality [22, 48]. Fourth, the assessment of well-being using a single subjective item (e.g., life satisfaction) may limit the understanding of how individuals experience various aspects of their lives that are crucial to critical outcomes [68]. Future studies on well-being should incorporate all major components, including both hedonic and eudaimonic aspects, rather than simplify it



to a single item measuring life satisfaction, income, or happiness [68–70]. On a positive note, the study benefits from a large and representative sample of adolescents from 42 countries, thereby enhancing the external validity of the findings.

## Conclusions

There is a nearly linear relationship between higher frequency of breakfast and greater life satisfaction in children and adolescents. Considering the potential health advantages associated with breakfast during this critical age phase, these findings underscore the importance of promoting breakfast consumption among children and adolescents. However, the causal direction of the association is not entirely clear and that other factors that have not been considered could influence life satisfaction, this recommendation should be interpreted with caution.

## Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12937-024-00979-5>.

Supplementary Material 1

## Author contributions

JFL-G designed the study. JFL-G contributed to the interpretation and analysis of the data. JFL-G wrote of the initial draft. MAT, CC-M, JB-S, ARG, JC, RL-B, and LS contributed to the revision of the manuscript. All authors approved the final version of the manuscript.

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## Data availability

No datasets were generated or analysed during the current study.

## Declarations

## Ethical approval

Each participating country obtained institutional ethics approval and written informed consent forms were signed by the schools, children, adolescents, and their parents or legal guardians. Notably, because the present study entailed a secondary analysis of anonymized data, formal approval from an ethics committee was deemed unnecessary.

## Competing interests

The authors declare no competing interests.

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