



Healthy Learning Mind (HLM): Cluster Randomized Controlled Trial on A Mindfulness Intervention, Moderators and Association with Perceived Socioeconomic Status, and Comparison to Other National Data

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Abstract

Background This paper presents the baseline characteristics and their moderators in the Healthy Learning Mind (HLM)– school-based cluster-randomized controlled trial.

Objectives The paper evaluates the state of various measures of well-being, their moderators and how these results compare to national and global norms/population studies.

Methods Data were collected from all participants prior to the intervention and further analyzed by gender, grade and perceived socioeconomic status, including standardized measures for resilience, depressive symptoms and socioemotional functioning; health-related quality of life, dispositional mindfulness, satisfaction with life, compassion/self-kindness, self-rated health and morning tiredness.

Results Participating 2793 students (1425 girls, 1368 boys), ages 12 to 15 years, filled in the questionnaires. The outcomes were in line with previous research, demonstrating gender differentiation and lower wellbeing among older children and adolescents.

Conclusions All outcomes were associated with perceived socioeconomic status, suggesting that perceived low socioeconomic status should be addressed as a serious risk factor and included as a moderator in similar trials.

Keywords Cluster randomized controlled trial · Adolescents · School-based intervention · Mindfulness · Perceived socioeconomic status · Baseline

Background

Adolescence is characterized by dynamic brain development and interaction with the social environment, shaping future trajectories and making the foundation for happy and healthy life. Resources for this development comprise physical, cognitive, emotional, social, and

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economic dimensions (Jensen & Arnett, 2012). Mental health problems constitute the most important contributing factor for decreased functional ability among adolescents (Patel, Flisher, Hetrick, & McGorry, 2007). In Finland, 14% of eight to nine years old children suffer from mental health problems, and the frequency increases at the onset of puberty to include 15 to 25% of adolescents (Kinnunen, Laukkanen, Kiviniemi, & Kylvä, 2010). Schoolwork can add to stress, academic demands seem to have a consistent effect on psychosomatic complaints among adolescents (Cosma et al., 2020) particularly among girls (Högberg, Strandh, & Hagquist, 2020). Heavy use of digital media is associated with mental health problems (Twenge & Martin, 2020). Recent research has confirmed that many aspects of adolescents and young adult's mental health and wellbeing are related to perceived financial situation (Sorgente & Lanz, 2017) and self-reported family affluence (Zaborskis & Grincaite, 2018).

The Healthy Learning Mind -study

The Healthy Learning Mind (HLM) -study is a carefully controlled, registered trial that evaluates the short and long term (6 and 12 months) effects of a mindfulness intervention (Stop and be) (Huppert & Johnson, 2010) compared to an active control program (relaxation) and non-treatment group. Mindfulness interventions with children and adolescents have shown improvement in cognitive capabilities, such as attention and emotion regulation, as well as psychological measures of stress, coping and resilience (Kuyken et al., 2013; Mak, Whittingham, Cunningham, & Boyd, 2018; Vickery & Dorjee, 2015).

Present Study

The purpose of this paper is to evaluate the state of well-being in a large (N=2973), representative group of students aged 12 to 15 years and to examine the main moderators for these baseline characteristics. Our aim is to determine whether these factors significantly moderate well-being data and how they compare to other data on both the national and global level in order to capture potential trends in the well-being of youth for the past decade. The students are divided into three age/ class groups: 6th graders (N=1039), 7th graders (N=504) and 8th graders (N=1250). The baseline data was collected between spring 2014 and 2016. The data present the three main outcome measures of the program, resilience, depressive symptoms, and socioemotional functioning together with a selection of secondary outcomes. We aimed to find out (1) how these results compare to national and global norms/population studies, also by age and gender and (2) how perceived SES is related to wellbeing outcomes.

Methods

Trial Design

The HLM -study is a cluster randomized controlled trial (RCT) with three arms. Participating schools were randomly assigned either to mindfulness intervention, to active relaxation control, or to nontreatment (waiting-list) groups. The ethical review board of the University

of Helsinki (approval 1/2014) reviewed the study plan. Recruitment, randomization procedure and larger questionnaire package are described in the study protocol (Volanen et al., 2016). Students filled in their questionnaires at school under facilitators' or teachers' monitoring before the intervention, forming the baseline assessment.

Moderators

Gender and age were considered as most likely moderators in analyzing the baseline data. Previous research has found consistent gender differences in psychological health and wellbeing suggesting that girls report poorer wellbeing in general compared to boys and the wellbeing tends to decrease in mid-adolescence for both genders (González-Carrasco, Casas, Malo, Viñas, & Dinisman, 2017; Michel, Gisela, Bisegger, Fuhr, & Abel, 2009; Moksnes & Espnes, 2013).

Students' family financial wellbeing was measured by *perceived socioeconomic status (perceived SES)*, given the importance of financial wellbeing for both psychological (Brüggen, Hogreve, Holmlund, Kabadayi, & Löfgren, 2017) and physical health and sleep outcomes (Hanson & Chen, 2007; Marco, Wolfson, Sparling, & Azuaje, 2012). Self-reported evaluation is crucial when considering the outcomes (Arber, Fenn, & Meadows, 2014), demonstrated in a longitudinal study that perceived financial wellbeing mediates the income related health outcomes, e.g. Chou et al. (2016) proposes that perceived financial wellbeing is linked to physical pain, mediated by sense of control. Research also indicates that 11–15 old children and adolescents are able to report material conditions in their family (Currie, Candace E., Elton, Todd, & Platt, 1997; Zaborskis & Grincaite, 2018).

Primary Outcome Measures

Resilience Scale (RS14) is a short version of the questionnaire to measure resilience (Wagnild & Young, 1993). Resilience represents the interaction between risk factors and resources (Kocalevent et al., 2015), i.e. a protective personality factor associated with stress resistance and adaptation in adverse situations (Rutten et al., 2013). Resilience Scale is a widely used resilience research instrument due to its good psychometric properties (CA 0.87–0.96.) (Aiena et al., 2014; Rutten et al., 2013; Wagnild & Collins, 2009) also as translated into Finnish (CA 0.90–0.87) (Losoi et al., 2013). Resilience is associated with mindfulness and has been found to mediate the outcomes of mindfulness for psychological wellbeing, life satisfaction and positive emotions (Bajaj & Pande, 2016; Sagone & Caroli, 2014). Resilience Scale is recommended to be used with adolescent population (Ahern, Kiehl, Lou Sole, & Byers, 2006). It has been applied beginning from the 6th grade (12 years) and demonstrates good reliability (CA 0.91) for racial/ethnic, age, geographic, and gender groupings in adolescence (Pritzker & Minter, 2014). Scoring high in RS14 indicates high resilience, but normative data for adolescent population are not available. Responses with at least ten out of fourteen questions answered were included and missing values were replaced with the mean values. Maximum score in the test is 98 and the total resilience score is reported. The range in our study was from 14 to 98.

Finnish version of the Beck Depression Inventory (RBDI) measures the level of depressive symptoms (Raitasalo, 2007) and is based on the Beck Depression Inventory (BDI) (Beck, 1961), a gold standard of depression screening. RBDI consisted of statements in 12

question categories, (excluding suicidal ideation). Missing answers were treated according to Raitasalo including data where at least eight out of twelve questions were answered (Raitasalo, 2007). RBDI has demonstrated adequate psychometric properties among youth (CA 0.83, 0.87) (Raitasalo, 2007). Symptoms of depression become more prevalent in teenage (Mojtabai, Olfson, & Han, 2016). Untreated depression is a serious illness, that requires early detection. RBDI is also part of the Finnish Student Health Survey, 8th grade (2016). The scoring is not to be used as diagnostic but can reveal symptoms of depression and the need for consultation and care. The norms in Finnish population are 0–4: no symptoms of depression, 5–7: mild symptoms of depression, 8–15: moderate symptoms of depression ja 16–39: serious symptoms of depression (Raitasalo, 2007). We report the total score of RBDI, with a range of 0 to 36 in our study.

Strengths and Difficulties Questionnaire (SDQ) measures socioemotional functioning with a brief (25-item) screening that has been recommended as a broad measure for mental health and wellbeing outcomes among children and adolescents, capable of detecting change over time (Deighton et al., 2014) and containing five dimensions: emotional symptoms, conduct problems, hyperactivity/inattention, peer relationship problems. SDQ has shown adequate psychometric properties in Finnish studies (Cronbach Alpha, CA, 0.71) and has been widely used in the Finnish context (Koskelainen, Sourander, & Kaljonen, 2000). Scores exceeding 90th percentile (18 points or more in our data) of the SDQ total difficulties scores in parent-, teacher- and self-reports have been strongly associated with help-seeking variables and problematic behavior according to parents (Koskelainen et al., 2000). Missing answers were treated according to questionnaire instructions including those responses where at least three out of the five questions in each subcategory were answered. As a result, we publish the total difficulties score of the test that excludes the prosocial dimension. The SDQ scores have been interpreted as 0–13 for close to average, 15–17 slightly raised (borderline), 18–19 high and 20–40 very high (clinical) difficulties (Goodman & Goodman, 2000). The range in our study was from 0 to 31.

Secondary Outcomes

The secondary outcomes in the HLM-study were conceptualized as cognitive – emotional factors essential for the children’s and adolescents’ resilience, mental health and well-being (Volanen et al., 2016).

KINDL-R was chosen to assess health-related quality of life in children and adolescents 3–17 years old (Ravens-Sieberer & Bullinger, 1998) having shown excellent psychometric properties (Harding, 2001; Solans et al., 2008). Three different versions of the instrument suitable for different age groups and developmental stages are provided, of which we utilized the one intended for children 7–13 years old. There are currently no norms for the Finnish population. Total score is reported when at least 17 out of 24 questions were answered as per questionnaire instructions as dictated in the *KINDL-R* manual (Ravens-Sieberer, Erhart, Wille, & Bullinger, 2000), ranging from 13.54 to 100 in our study.

Child and Adolescent Mindfulness Measure (CAMM) (10-items) measures the effect of mindfulness intervention on dispositional (trait) mindfulness (Greco, Baer, & Smith, 2011). Higher scores indicate higher trait mindfulness. The range in the test is 0–40 (also in this study), and the total score is reported when at least seven out of ten questions are answered.

The Satisfaction with Life for Children (SWLS-C) is an adaptation (Gadermann, Guhn, & Zumbo, 2010) of the original (Diener, Emmons, Larsen, & Grifflins, 1985) satisfaction with life scale (SWLS) for over 10 years old children and adolescents. It consists of five questions designed to measure global cognitive judgments of satisfaction with one's life. Higher scores indicate higher life satisfaction. The range in the test is 5 to 25 (also in our study), and the total score of the questionnaire is reported when at least four out of five questions were answered.

Self-kindness subscale from self-compassion questionnaire (C/SK) is to measure this particular dimension of self-compassion, representing the ability to take an active role in cultivating care and warmth toward oneself (i.e. self-soothing behaviors) (Neff, 2003). Self-compassion may enhance general wellbeing and diminish depressive symptoms (Neff & McGehee, 2010). Higher scores indicate higher self-kindness. The range in the test is 1–5 (also in our study), and the total score of the subscale is reported, when at least four out of five questions were answered.

Health-Related Outcomes

The questions on health-related outcomes were obtained from the Finnish part of the Health Behaviour in School-Aged Children (HBSC) Study – a World Health Organization (WHO) collaborative cross-national study (Currie, Gabhainn, & Godeau, 2009). Students' subjective health was measured with *Self-rated health (SRH)*: 'Would you say your health is...?' The response options were "excellent", "good", "fair" and "poor". Experienced *morning tiredness (MT)* is an answer to one of the questions probing sleep and rest: "During the last month, how often did you feel tired when you got up on a school morning?" The answer options were "seldom or never", "occasionally", "1–3 times per week" and "4 or more times per week".

Statistical Analysis

Continuous outcomes (SDQ, RBDI, RS14, KINDL-R, CAMM, SWLS-C and C/SK) were described with means, standard deviations and ranges. Categorical outcomes (SRH and MT) measures were summarized using frequencies and percentages. The descriptive statistics is presented for all children, by gender, by grade and by perceived SES categories. The mean differences in continuous outcomes between genders, grades and perceived SES categories were tested with multilevel linear model using Tukey's adjustment in pairwise comparisons. Categorical outcomes were analysed with multilevel ordinal logistic regression using Bonferroni correction in pairwise comparisons. Three-level models with student at level 1, students in a particular classroom at level 2, and school at level 3 were fitted to account for the clustered nature of the data. Intra-class correlation (ICC), which is the proportion of the total variance explained by each level, were calculated to examine the intra-class correlations among classrooms and schools. Correlations between continuous outcome measures were calculated with Pearson correlation coefficients and between ordinal and continuous outcome measures with Spearman rank-order correlation coefficients. Correlation between KINDL-R and C/SK were further analysed for gender and grade. P-values less than 0.05 were considered statistically significant. Statistical calculations were done using SAS System for Windows, version 9.4 (SAS Institute Inc., Cary, NC).

Results

The completeness of data at the baseline was 97% or greater for all outcome metrics excluding RBDI, where the completeness of male participants was 92% (females 97%).

Table 1 gives an overview of the descriptive statistics of all the results grouped. In Table 2 the data is split to males and females and in Table 3 to grades from 6th to 8th. Table 4 presents outcome variables by perceived SES categories. Finally, Table 5 presents the Pearson correlation coefficients (all data in the upper right-hand corner, and split into two genders, females / males, in the lower left-hand corner) and Spearman correlation coefficients for the categorical variables SRH and MT.

Perceived SES (what do think about the financial situation in your family) was measured by 4 response categories: 48.9% were in the income group 1 (does very well financially), 35.7% in group 2 (does moderately well), 12.8% in the group 3 (does as average) and 2.5% in group 4 (does not well or at all well financially).

Primary Outcomes

The mean RS14 score for all participants was 77.01 (11.39). For girls, the mean score was 76.9 (11.43) and for boys slightly higher at 77.13 (10.95) but the difference was not significant ($p=0.743$). The mean trait resilience did not change with increasing age ($p=0.743$). For class grade 6 the mean RS14 score was 77.32 (10.47) for 7th grade 77.18 (12.15) and 76.69 (11.37) for 8th grade. The association between perceived SES and mean trait resilience was significant. Students with higher perceived SES had higher RS14 scores than students with lower SES ($p<0.001$). The differences in mean trait resilience between the SES categories were all statistically significant, except when comparing the two middle categories (doing well and moderately well financially).

The mean RBDI score for all participants was 2.14 (3.92). Girls had significantly higher mean RBDI 2.67 (4.33) compared to boys 1.56 (3.32) ($p<0.001$). The mean RBDI score associated positively with class grade from 1.8 (3.82) (6th grade) to 2.08 (3.87) (7th grade) and further to 2.44 (4.00) (8th grade) signaling significantly worsened wellbeing between 6th and 8th grade ($p=0.010$), even if the average is still within the range of no depressive symptoms. Perceived SES was associated with the results in all categories ($p<0.001$), indicating that students with higher perceived SES had lower RBDI scores.

The mean experienced psychological SDQ score for all participants was 10.31 (5.45). Girls had slightly higher mean SDQ, 10.39 (5.3) compared to boys 10.21 (5.61) but there was no significant difference ($p=0.396$). A significant difference is observed in the SDQ scores indicating increased experienced difficulties from 6th to 8th grade ($p=0.002$). The 6th graders had a mean SDQ score 9.75 (5.3), 7th graders 10.17(5.53), and 8th graders 10.82 (5.5). SDQ was associated with perceived SES in all its categories ($p<0.001$, in perceived SES categories 3 vs. 4+5 $p=0.002$), indicating that those with higher perceived SES had also lower SDQ scores.

Secondary Outcomes

The mean KINDL-R score for all participants was 70.45 (12.84). Girls had significantly lower mean KINDL-R score, 69.39 (13.03), compared to boys, 71.57 (12.53) ($p<0.001$).

A decreasing significant trend in quality of life was observed with increasing age (from 6th to 7th grade $p < 0.01$ and 6th to 8th grade $p < 0.001$). KINDL-R scores were 72.54 (12.70) (6th grade), 70.57 (12.93) (7th grade) and 68.68 (12.65) (8th grade). Perceived SES was associated with the results in all categories ($p < 0.001$), indicating that students with higher perceived SES had higher KINDL-R scores.

Mindfulness (CAMM) mean score for the whole group was 26.77 (6.31). Girls, 26.2 (6.31), were significantly less mindful than boys, 27.37 (6.25) ($p < 0.001$), according to CAMM results. The CAMM scores in grade 6 were 27.08 (5.87), in grade 7 were 27.10 (6.74), and in grade 8 were 26.39 (6.45) indicating a significant drop from 6th to 8th grade ($p = 0.041$). The association between perceived SES and mean mindfulness was significant. Students with higher perceived SES had higher mindfulness scores than students with lower SES ($p < 0.001$). The differences in mean mindfulness between the SES categories were all statistically significant ($p < 0.001$, in SES categories 3 vs. 4 + 5 $p = 0.007$), except when comparing the two middle categories (doing well and moderately well financially).

Satisfaction with life (SWLS-C) mean score for the whole group was 19.37 (3.99). Girls, 18.98 (4.16), were significantly less satisfied with their lives compared to boys, 19.78 (3.78) ($p < 0.001$). A significant inverse trend in satisfaction with life was observed with age ($p < 0.001$): 20.2 (3.74) (6th grade), 19.42 (4.00) (7th grade), and 18.66 (4.06) (8th grade). Perceived SES was associated with the results in all categories ($p < 0.001$), indicating that students with higher SES had higher SWLS-C scores.

The mean C/SK score for all participants was 3.29 (0.90). The girls were significantly less kind towards themselves, score 3.24 (0.91), compared to boys, 3.34 (0.88) ($p = 0.005$). The mean self-kindness showed a significant negative trend with age from grade 6, 3.40 (0.87), to grade 7, 3.30 (0.90), and to grade 8 3.20 (0.91) (6th to 8th grade, $p < 0.001$). Perceived SES was associated with the results in all categories ($p < 0.001$, SES categories 2 vs. 3 $p = 0.002$), indicating that students with higher SES had higher C/SK scores.

Health-Related Outcomes

Most students rated their health as good or excellent. Self-rated health (SRH) was excellent for 39.7%, good for 54.6%, fair for 5.4%, and bad for 0.3% of all participants. Boys gave higher ratings to their health than did girls (43.5% vs. 36.1% rating excellent health). Similarly, the percentage of those who rated their health as excellent declined somewhat with age, being 41.1% for 6th graders, 40.2% for 7th graders and 37.6% for 8th graders, but the trend was not significant ($p = 0.186$, Table 3). The level of perceived SES was reflected in SRH when we compared those who were doing very well financially to other groups ($p < 0.001$).

Morning tiredness (MT) was for all participants present seldom or never for 15.6%, occasionally 37.4%, 1–3 times per week 25.9%, and 4–7 times per week 21.0%. Girls reported feeling more tired (4–7 times per week) when waking up than boys (23.7% vs. 18.2%). Morning tiredness also increased significantly with age i.e. 13.6% of 6th graders, 18.2% of 7th graders, and 28.3% of 8th graders were tired 4–7 times per week ($p < 0.001$) (Table 4). The level of perceived SES was reflected in MT when we compared those whose family was doing very well/well financially to those with moderate or lower perceived SES ($p < 0.001$).

Table 1 Descriptive statistics and intra-class correlations (ICC) at classroom and school level, all participants

Variable	N	Mean (SD)	Min—Max	ICC classroom / school
Socioemotional functioning (SDQ)	2737	10.31 (5.55)	0–31	0.046 / 0.008
Depressive symptoms (RBDI)	2642	2.14 (3.92)	0–36	0.014 / 0.010
Resilience (RS14)	2780	77.01 (11.19)	14–98	0.043 / 0.009
Health-related quality of life (KINDL-R)	2747	70.45 (12.84)	13.5–100	0.034 / 0.021
Dispositional mindfulness (CAMM)	2773	26.77 (6.31)	0–40	0.018 / 0.003
Satisfaction with life (SWLS-C)	2773	19.37 (3.99)	5–25	0.022 / 0.031
Self-compassion (C/SK)	2769	3.29 (0.90)	1–5	0.014 / 0.013
Self-rated health (SRH), n (%)	2770			0.032 / 0.008
Excellent		1100 (39.7)		
Good		1512 (54.6)		
Fair or bad		158 (5.7)		
Morning tiredness (MT), n (%)	2705			0.016 / 0.047
Seldom or never		423 (15.6)		
Occasionally		1012 (37.4)		
1–3 times per week		701 (25.9)		
4–7 times per week		569 (21.0)		

Table 2 Descriptive statistics by gender

Variable	Mean (SD)			P-value
	Female / Male	Female	Male	
Socioemotional functioning (SDQ)	1398 / 1339	10.39 (5.3)	10.21 (5.61)	0.396
Depressive symptoms (RBDI)	1383 / 1259	2.67 (4.33)	1.56 (3.32)	<0.001
Resilience (RS14)	1415 / 1365	76.9 (11.43)	77.13 (10.95)	0.713
Health-related quality of life (KINDL-R)	1411 / 1336	69.39 (13.03)	71.57 (12.53)	<0.001
Dispositional mindfulness (CAMM)	1418 / 1355	26.2 (6.31)	27.37 (6.25)	<0.001
Satisfaction with life (SWLS-C)	1410 / 1363	18.98 (4.16)	19.78 (3.78)	<0.001
Self-compassion (C/SK)	1417 / 1352	3.24 (0.91)	3.34 (0.88)	0.005
Self-rated health (SRH), n (%)	1412 / 1358			<0.001
Excellent		509 (36.0)	591 (43.5)	
Good		810 (57.4)	702 (51.7)	
Fair or bad		93 (6.6)	65 (4.8)	
Morning tiredness (MT), n (%)	1401 / 1304			<0.001
Seldom or never		176 (12.6)	247 (18.9)	
Occasionally		537 (38.3)	475 (36.4)	
1–3 times per week		356 (25.4)	345 (26.5)	
4–7 times per week		332 (23.7)	237 (18.2)	

Table 3 Descriptive statistics, grades 6th to 8th

Variable	N	Mean (SD)			P-value
		6th / 7th / 8th	6th	7th	
Socioemotional functioning (SDQ)	1009 / 500 / 1228	9.75 (5.3)	10.17 (5.53)	10.82 (5.5)	0.002
Depressive symptoms (RBDI)	969 / 475 / 1198	1.80 (3.82)	2.08 (3.87)	2.44 (4)	0.011
Resilience (RS14)	1036 / 502 / 1242	77.32 (10.47)	77.18 (12.15)	76.69 (11.37)	0.743
Health-related quality of life (KINDL-R)	1018 / 496 / 1233	72.54 (12.70)	70.57 (12.93)	68.68 (12.65)	<0.001
Dispositional mindfulness (CAMM)	1031 / 501 / 1241	27.08 (5.87)	27.10 (6.74)	26.39 (6.45)	0.041
Satisfaction with life (SWLS-C)	1031 / 502 / 1240	20.20 (3.74)	19.42 (4)	18.66 (4.06)	<0.001
Self-compassion (C/SK)	1029 / 501 / 1239	3.40 (0.87)	3.30 (0.90)	3.20 (0.91)	<0.001
Self-rated health (SRH), n (%)	1027 / 503 / 1240				0.186
Excellent		432 (42.1)	202 (40.2)	466 (37.6)	
Good		547 (53.3)	271 (53.9)	694 (56.0)	
Fair or bad		48 (4.7)	30 (6.0)	80 (6.4)	
Morning tiredness (MT), n (%)	1005 / 483 / 1217				<0.001
Seldom or never		234 (23.3)	68 (14.1)	121 (9.9)	
Occasionally		404 (40.2)	188 (38.9)	420 (34.5)	
1–3 times per week		230 (22.9)	139 (28.8)	332 (27.3)	
4–7 times per week		137 (13.6)	88 (18.2)	344 (28.3)	

Significant pairwise differences between grades, the number of symbols refer to level of significance (* $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$): for SDQ 6 vs. 8**, for RBDI 6 vs. 8*, for KINDL-R 6 vs. 8***, for CAMM no significant pairwise differences; for SWLS-C 6 vs. 7*, 6 vs. 8***, 7 vs. 8**, for C/SK 6 vs. 8***, for MT 6 vs. 7***, 6 vs. 8***, 7 vs. 8***

Cross Correlations

Table 5. presents the Pearson (for continuous outcomes) or Spearman (for SRH and MT) correlation coefficients between the metrics. The upper right-hand corner displays the coefficients when all subjects are treated together whereas the lower left-hand corner presents the coefficients of girls / boys separately.

The most pronounced cross correlations, those that exceed 0.6, were observed for the whole group between KINDL-R and SDQ (-0.69), and between KINDL-R and RBDI (-0.64) indicating that different perspectives of wellbeing can be highly related. This is also demonstrated by 36 cross correlation pairs, of which 28 had a coefficient of 0.30 or higher. For girls, pairs SDQ and RBDI (0.62), RBDI and KINDL-R (-0.67), KINDL-R and SWLS-C (0.66), and RBDI and SWLS-C (-0.61) also exceeded the same threshold 0.6, as did SDQ and KINDL-R for both boys and girls (-0.71/-0.66). Of 36 cross correlation pairs, 29 were above 0.30 for girls, and 25 for boys. Taking a look at the class grades, the cross correlations between KINDL-R~SWLS-C were above 0.6 for both 6th and 7th graders.

Discussion

Our baseline data was comparable and mostly in line with current norms and population studies. The results confirmed persistent gender differences in wellbeing outcomes, showing

Table 4 Perceived socioeconomic status (perceived SES) by outcome variables

Variable	N	Perceived socioeconomic status: mean (SD)				P-value
		1 / 2 / 3 / 4+5	Does very well (1)	Does moderately well (2)	Does as average (3)	
Socioemotional functioning (SDQ)	1280 / 935 / 333 / 67	9.20 (5.10)	10.67 (5.43)	12.22 (5.59)	14.66 (6.08)	<0.001
Depressive symptoms (RBDI)	1235 / 919 / 328 / 64	1.43 (2.90)	2.38 (4.24)	3.37 (5.01)	6.27 (6.06)	<0.001
Resilience (RS14)	1294 / 941 / 338 / 67	79.05 (10.73)	76.14 (10.73)	74.59 (11.33)	67.33 (14.29)	<0.001
Health-related quality of life (KINDL-R)	1289 / 941 / 338 / 67	74.01 (11.98)	68.58 (12.15)	65.27 (12.96)	58.64 (14.15)	<0.001
Dispositional mindfulness (CAMM)	1290 / 943 / 339 / 67	27.64 (6.05)	26.29 (6.17)	25.92 (6.79)	23.28 (7.32)	<0.001
Satisfaction with life (SWLS-C)	1289 / 941 / 338 / 67	20.67 (3.42)	18.71 (3.85)	17.67 (4.09)	13.84 (4.92)	<0.001
Self-compassion (C/SK)	1283 / 943 / 339 / 67	3.44 (0.90)	3.25 (0.86)	3.05 (0.84)	2.53 (0.87)	<0.001
Self-rated health (SRH), n (%)	1291 / 940 / 334 / 67					<0.001
Excellent		633 (49.0)	311 (33.1)	95 (28.4)	10 (14.9)	
Good		616 (47.7)	569 (60.5)	206 (61.7)	44 (65.7)	
Fair or bad		42 (3.3)	60 (6.4)	33 (9.9)	13 (19.4)	
Morning tiredness (MT), n (%)	1272 / 939 / 334 / 66					<0.001
Seldom or never		257 (20.2)	117 (12.5)	24 (7.2)	4 (6.1)	
Occasionally		501 (39.4)	364 (38.8)	110 (32.9)	14 (21.2)	
1-3 times per week		285 (22.4)	267 (28.4)	105 (31.4)	19 (28.8)	
4-7 times per week		229 (18.0)	191 (20.3)	95 (28.4)	29 (43.9)	

All other pairwise differences between subjective financial wellbeing categories were significant at level $p < 0.001$ *** except for SDQ 3 vs. 4**, for RS-14 2 vs. 3 NS; for CAMM 2 vs. 3 NS, 3 vs. 4+5**, for C/SK 2 vs. 3**, for HATM 2 vs. 3 NS, 3 vs. 4+5*; for MT 2 vs. 3**, 3 vs. 4+5 NS. The number of symbols refer to level of significance (* $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$)

Table 5 Cross-correlations among outcome variables

	Socio-emotional functioning (SDQ)	Depressive symptoms (RBDI)	Resilience (RS14)	Health-related quality of life (KINDL-R)	Dispositional mindfulness (CAMM)	Satisfaction with life (SWLSC)	Self-kindness (C/SK)	Self-rated health (SRH)	Morning tiredness (MT)
Socio-emotional functioning (SDQ)	1	0.55	-0.46	-0.69	-0.56	-0.49	-0.36	0.36	0.33
Depressive symptoms (RBDI)	0.62/0.47	1	-0.45	-0.64	-0.41	-0.55	-0.35	0.33	0.39
Resilience (RS14)	-0.49/0.43	-0.51/0.37	1	0.57	0.31	0.55	0.52	-0.35	-0.20
Health-related quality of life (KINDL-R)	-0.71/0.66	-0.67/0.58	0.58/0.55	1	0.50	0.63	0.46	-0.45	-0.41
Dispositional mindfulness (CAMM)	-0.58/0.54	-0.46/0.32	0.34/0.28	0.53/0.46	1	0.36	0.20	-0.26	-0.26
Satisfaction with life (SWLSC)	-0.54/0.43	-0.61/0.45	0.57/0.53	0.66/0.60	0.40/0.30	1	0.47	-0.38	-0.28
Self-kindness (C/SK)	-0.42/0.30	-0.42/0.25	0.55/0.48	0.51/0.40	0.26/0.14	0.50/0.43	1	-0.24	-0.24
Self-rated health (SRH)	0.40/0.32	0.36/0.28	-0.35/0.35	-0.49/-0.40	-0.29/0.22	-0.40/0.35	-0.27/0.20	1	0.22
Morning tiredness (MT)	0.34/0.32	0.41/0.35	-0.23/0.17	-0.43/-0.38	-0.27/0.24	-0.30/0.26	-0.26/0.20	0.22/0.21	1

that in line with previous research, girls achieve lower wellbeing compared to boys. This does not apply to resilience, that seems to be more gender neutral than other wellbeing measures. There are many tentative explanations that could account for the difference, mostly focusing on coping skills and negative life events, that girls report more than boys (e.g. sexual abuse, harassment and victimization) (Petersen et al., 2001). During adolescence, girls have higher self-consciousness that may lead to self-critique, negative affect, lower self-compassion and more rumination (Hyde, Mezulis, & Abramson, 2008). Cognitive and affective style together with biological factors (genetic vulnerability, pubertal timing, development and hormonal changes) and negative life events (Hyde et al., 2008) contribute to

increased vulnerability to depression and lower wellbeing. It is also worth noting that girls consume more digital/social media and are also more affected by the negative consequences (Twenge & Martin, 2020). The majority of the wellbeing outcomes shows a decreasing trend with age, highlighting the need for mental health promotion and prevention especially among older adolescents, particularly girls.

We discovered that perceived socioeconomic status was consistently related to primary and secondary outcomes, showing better outcomes with higher levels of perceived SES, including mindfulness and self-compassion outcomes that have previously not been examined in relation to perceived SES. To our knowledge, this is the first large scale RCT on the effects of mindfulness where adolescent experience of family financial wellbeing has been included and can be examined as a moderator. A systematic review on mindfulness in low-income schools found that mindfulness training in schools may improve the access to mental wellbeing interventions for low-income youth and enrollment was generally high, even if the outcome results were mixed. The adherence to home-practice may be also difficult to maintain (Segal et al., 2021).

Our results related to the baseline characteristics indicate that measuring perceived SES should be routinely included in similar trials. Subjective measures enable individuals to evaluate the experience of their own financial situation by both cognitive and affective reactions (Diener et al., 1985). They are also better equipped to examine non-financial effects (e.g. societal attitudes towards wealth). Living community and peer group can also affect how individuals perceive their situation compared to others (Dolan, Peasgood, & White, 2008). Despite previous findings, indicating that affluence in general does not seem to affect sleep patterns (e.g. Garipey et al., 2020), our results suggest that for children and adolescents they may be related. These results are perhaps not surprising but underline the importance of measuring financial wellbeing and how it is experienced in families, as well as considering the burden to comprehensive student health outcomes. As observed earlier (Arber et al., 2014), perceived financial wellbeing mediates the income related health outcomes for adults and may have similar pathways in adolescence. Family financial stress can have many effects, some mediated and some direct, but still acutely experienced by all family members (Ponnet, 2014).

Primary Outcomes

The RS14 scores in our study for resilience, varying between 76.7 and 77.1 for different subgroups, correspond well with the scores in previous studies among adolescent population (Damásio, Borsa, & da Silva, 2011; Salazar-Pousada, Arroyo, Hidalgo, Pérez-López, & Chedraui, 2010). Resilience has a tendency to increase with age and has not shown any specific relation to gender (Lundman, Strandberg, Eisemann, Gustafson, & Brulin, 2007; Nishi, Uehara, Kondo, & Matsuoka, 2010; Wagnild, 2010). For example, in the Finnish adult population the scores have been remarkably similar for both genders (Losoi et al., 2013) and only slightly differ from the adolescent scores in the present study. The gender neutrality of resilience among adolescents requires more investigation but it suggests that the development of resilience may have common pathways for both genders, counterbalancing adversity with coping skills (Zolkoski & Bullock, 2012). Overall Finnish adolescents seem to have resilience levels similar to other national samples.

In the present study the mean RBDI for all clusters were below the clinical symptom threshold. Our data show that 8.2% of girls and 4.4% of boys have symptoms of mild depression whereas 10.3% of girls and 4.6% of boys have symptoms of moderate or serious depression. In the 8th grade 8.8% of students have symptoms of moderate or serious depression. Depressive symptoms in the young Finnish population have been followed 1997–2008 (Luopa, Lommi, Kinnunen, & Jokela, 2010). Corresponding with the evidence from past decades (Cyranowski, Frank, Young, & Shear, 2000), girls have reported more depressive symptoms than boys: 14% of girls and 3% of boys have reported symptoms of mild depression whereas 7% of girls and 1% of boys have reported symptoms of moderate or serious depression and in the 8th grade 13% of students have symptoms of moderate or serious depression (compared to 8.8% in our study in this age-group). In light of our findings, it seems that severity of depressive symptoms has increased among both genders, even if the symptoms have not increased overall and are even lower for the 8th graders. This corresponds with recent cohort studies in Finland (Gyllenberg et al., 2018) finding a considerable increase in the use of psychiatric services among adolescents. There are many possible causes for these observations, but many have suggested that e.g. heavy use of digital media is more likely to result in lower wellbeing or mental health issues, and these effects are larger among girls (Twenge & Martin, 2020).

It is difficult to compare RBDI directly with other national samples as child and adolescent depression has been measured with various instruments over the years. However, the classification of mild, moderate and serious depression sets a standard to compare with population studies in Finland and elsewhere. Studies have found that 3–9% of teenagers meet criteria for depression at any one time (lifetime prevalence 20%) and our results are in line with this (Thapar, Collishaw, Pine, & Thapar, 2012; Zuckerbrot & Jensen, 2006). The most commonly mentioned contributors are puberty, accelerated brain development and cognitive maturation (Blakemore, 2008).

The mean strengths and difficulties (SDQ) scores for all clusters were in the average range and total score mean 10.31 (5.5), which is somewhat lower than 11.2 (5.4) found in previous cohort (13–17 old) studies in Finland (Koskelainen, Sourander, & Vauras, 2001). This may be explained by somewhat older cohort in the study by Koskelainen et al. (2001), as socioemotional functioning tends to decrease for older teenagers. Our findings can be compared with the total score means in respective adolescent studies from South Africa (11.79), UK (10.3), Australia (8.94) and China (10.60) (De Vries, Davids, Mathews, & Aarø, 2018). In the national population studies 9.2% of adolescents in the UK were in the clinical range, in South Africa 9.1% were in the clinical range and in Spain 3.2% (Serra-Sutton et al., 2009), as compared to 9.4% in our study. Our data seem to correspond with other national samples, even if the norms are country specific.

Secondary Outcomes

In the present study, the mean KINDL-R score was 69.72 (13.11), showing significantly lower total score among girls (69.39) compared to boys (71.57). Health-related quality of life (KINDL-R) total score means in similar age-groups have been reported in Germany 75.7 (9.9) (Ravens-Sieberer et al., 1998), in Spain (74.5) (Serra-Sutton et al., 2009) and in Norway 79.4 for girls and 82.2 for boys (Jozefiak, Larsson, & Wichstrøm, 2009). This gender effect is also shown in previous studies (Michel, G., Bisegger, & Fuhr, 2009). The

degrading trend of health-related quality of life with increasing age is also consistent with previous studies (Michel et al., 2009; Ravens-Sieberer et al., 2007). The Finnish scores are also somewhat lower than the ones found in European population studies (Jozefiak et al., 2009; Vanaelst et al., 2012). As we have no previous norms for KINDL-R in Finland, this indicates a need for further investigation. Quality of school life has been found to be lower than the OECD average in Finland, which may also give some support to these preliminary findings (Yoon & Järvinen, 2016).

Dispositional mindfulness, measured by CAMM, mean scores (26.2 to 27.37), demonstrated relatively high scores of mindfulness. The first study to use CAMM among 10-17-year olds ($n=319$) (Greco et al., 2011) showed mean CAMM score for all participants 22.73 (7.33) (no significant gender differences), scores increasing with age. In the Netherlands with comparable age groups total score has been reported 28.6 (6.33) and decreasing scores by age (de Bruin, Zijlstra, & Bögels, 2013), boys scoring higher than girls. In our study boys also reported higher mindfulness and there was a slight decrease in scores from 7th to 8th grade. Our data seem to correspond with the Dutch national sample and show similar effects of moderating age and gender.

Satisfaction with life for children scores in our study varied (18.66–20.2) for different subgroups. Validity studies have shown decreasing life satisfaction with age in adolescent population. A large-scale study (Gadermann, Schonert-Reichl, & Zumbo, 2010) to use SWLS-C among 9-12-year olds found that SWLS-C for girls decreased while boys maintained the previous level. A Norwegian study among 13-18-year old found total mean score 24.00, slightly higher scores for boys than girls (Moksnes, Løhre, Byrne, & Haugan, 2014). Our study replicates these trends, finding that satisfaction with life tends to decrease with age and is moderated by gender. Our mean scores compare slightly lower to Norwegian sample but other national samples are still waiting to be reported.

The compassion/self-kindness scores in our study varied between 3.29 (0.9), for girls 3.24 (0.91) and for boys slightly higher at 3.34 (0.88) and seemed to decrease with age, from 3.40 (0.87) in the 6th grade to 3.20 (0.91) in the 8th grade. This aligns with previous research, indicating that self-compassion is lower for girls than boys, especially in older adolescents (Yarnell et al., 2015) (Yarnell et al., 2015). In a study among Portuguese adolescents (from 12 to 19-years old) mean C/SK was 2.86 (0.77) but there is still very little research elsewhere on separate dimensions of Self-Compassion Scale, to allow comparisons.

Health-Related Outcomes

Students' self-rated health (SRH) was rated mostly as excellent (39.7%) or good (54.6%). These results are higher than earlier findings from studies in Finland (Markkanen, Välimaa, & Kannas, 2019), possibly partly due to schools' location in Southern Finland and partly due to the somewhat higher perceived SES among adolescents in the current study as compared to similar Finnish studies.

When correlated with other outcomes MT seems to be most related to negative health-related quality of life, in line with previous findings (Paiva et al., 2014). Insufficient sleep and persistent tiredness can also lead to behavioral problems and emotional disorders (Saarenpää-Heikkilä, Rintahaka, Laippala, & Koivikko, 1995). In one Finnish study among 11, 13 and 15-year old adolescents (Tynjälä, Kannas, & Levälähti, 2003) perceived tiredness at least four school mornings a week (considered chronic tiredness) increased with age from

24 to 35% among boys and from 16 to 34% among girls. Feeling tired more often than once a week increased from 20 to 37% in girls and from 24 to 50% in boys. In our data perceived tiredness at least four school mornings a week increased from 14 to 28% among all participants (from 12 to 15-year-olds). Feeling tired more often than once a week increased with age from 23 to 27% in all participants. Also, if we compare the data to an earlier study, both girls and boys seem to be less tired at waking (more than four times a week 23% of girls, 18% of boys) compared to two decades ago (Tynjälä et al., 2003). This corresponds to earlier studies on Finnish sleep trend (e.g. Kronholm et al., 2015), suggesting that the increasing trend in youth insomnia and tiredness may have stopped and even reversed slightly around 2008. It also seems that girls suffer more from insomnia and tiredness after puberty, whereas the gender differences at earlier age are less clear (Luntamo et al., 2015).

Cross-Correlation

As we found the most pronounced cross-correlations for health-related quality of life (KINDL-R) together with socioemotional functioning (SDQ) and depressive symptoms (RBDI), we could argue that these questionnaires address the variable of well-being from different perspectives but are highly related. Health related quality of life seems to be competent in capturing some common elements of wellbeing and we suggest it as a comprehensive measure that can give useful information in similar trials. Correlations are in general stronger for girls compared to boys, stay quite stable across grades and are stronger for Health-related quality of life compared with other examined variables. Interestingly, self-kindness (C/SK) does not seem to have a strong relation with mindfulness (CAMM), which may indicate that this aspect of wellbeing is not directly related with dispositional mindfulness and may require practice.

Limitations and Future Research

We acknowledge that the sample of students in our study is relatively affluent, compared to many other studies. This may be due to location (Southern Finland) and also the selection, as not all schools in the area are included. This sets limits to diversity and also to the applicability of the results. However, it is likely that the differences, particularly the moderating effect of perceived SES, would be even larger in more diverse samples.

We found that the moderating effects of gender, age and perceived socioeconomic status should be considered as important moderating factors when studying child and adolescent well-being. These moderators should be included in the research design when aiming to improve well-being in youth, not only in the field of mindfulness but also when considering socioemotional learning, health education and learning skills in general. In the future we need consistent follow-ups of well-being data on both the national and global level in order to better understand and anticipate how the educational environment can offer appropriate support and optimal interventions in particular developmental stages.

Conclusions

The HLM-study has been one of the first large-scale cluster randomized controlled trials (RCT) examining school-based mindfulness interventions. The baseline data with high response rate suggest that the participants are representative of children and adolescents in Finland and results largely reflect the existing research. Comparison to other national data is partly difficult due to varying age groups and samples, but our findings are mostly in line with population studies elsewhere. We also suggest that moderating effects of gender, age and perceived socioeconomic status should be considered in similar trials. Moreover, our data showed that girls had more depressive symptoms than boys and lower scores in mindfulness and self-kindness. A larger part of the adolescent sample suffered from moderate and severe depression than from mild depression, contrary to previous findings. Further results showed that girls have lower quality of life scores than boys and quality of life is somewhat lower compared to European data. For all outcomes, the gender differentiation was apparent, and girls were consistently worse off in terms of wellbeing. As expected, older adolescents experience more disruption in their wellbeing, and results were again consistent across outcomes. Perceived socioeconomic status is associated with the results across health and wellbeing outcomes, i.e. higher the financial wellbeing, higher the wellbeing overall. These findings indicate that when considering the potential risk factors to adolescent health, self-reported socioeconomic inequalities should be addressed.

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Trial Registration Healthy Learning Mind—a school-based mindfulness and relaxation program: a study protocol for a cluster randomized controlled trial ISRCTN18642659 was retrospectively registered 13 October 2015. The full trial protocol can be accessed at <http://rdcu.be/t57S>.

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