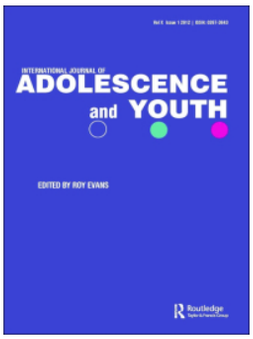

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Association between health information seeking and behaviour change related to physical activity among Qatari adolescents

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ABSTRACT

This study aims to assess the influence of used information sources on behaviour change related to physical activity (PA). It analyses secondary data from a nationally representative cross-sectional survey conducted in 2017 among 1050 Qatari adolescents aged 13–19 years. Multivariable logistic regression accounting for survey design examined the association between the outcome (attempt to change PA) and interpersonal, online, traditional, and social media information sources. Adolescents who used information from interpersonal and online sources to attempt changing their behaviour had nine times (95% confidence interval [CI]: 4.15–21.08) and nearly three times (95% CI: 1.50–4.27) higher odds of a change in PA behaviour, respectively. The estimated average marginal effects of using information from interpersonal and online sources were 46-percentage point and 16-percentage point increase in the probability of attempting PA behaviour change, respectively. Policymakers may benefit from this research in designing appropriate PA interventions that adapt multiple delivery approaches.

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KEYWORDS
Adolescents; health information seeking; physical activity; Qatar

Introduction

Adolescence is one of the most rapid phases of human development in physical, psychological, and social aspects that needs special attention (World Health Organization, 2023). At 1.3 billion, adolescents comprise around 16% of the world's population (United Nations Children's Fund, 2022). They constitute one-fifth of the populations of the Eastern Mediterranean region (EMR) (World Health Organization, 2023), more than a quarter of Arab Gulf Countries (Al Makadma, 2017), and nearly 7.6% of the population in Qatar (Qatar Ministry of Development Planning and Statistics, 2023). Adequate physical activity (PA) in adolescents has considerable benefits for their health and well-being, extending to adulthood (World Health Organization, 2022). However, an astounding majority of this segment of the population worldwide does not meet the PA requirements set by the World Health Organization (WHO) (World Health Organization, 2021b). The highest level of insufficient activity is recorded in the EMR (87%) compared to other WHO regions (World Health Organization, 2021b), and Qatar has the second highest level (88.2%) among adolescents in the entire EMR (World Health Organization, 2021a).

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It is important, yet challenging, to educate adolescents about healthy behaviours, as it is hard to capture their attention. Fortunately, teens are information seekers triggered by their information need (Esmaeilzadeh et al., 2018; Martinović et al., 2023). They search different topics using multiple sources, from traditional to new digital technologies, which may elicit their behaviour change, as reported by western literature (Freeman et al., 2020; Martinović et al., 2023). The sources and topics vary according to different characteristics and correlates, such as age, sex, motivation, type of information needed, and search skills (Martinović et al., 2023; Wartella et al., 2016).

In the context of the Arab region, particularly Qatar, numerous studies have primarily concentrated on assessing the general level of PA among adolescents. However, these studies have placed limited emphasis on recognizing the significance of this behaviour for adolescents and the factors that might influence or alter it (Al-Thani et al., 2018; Daradkeh et al., 2015; Ibrahim et al., 2018; Subhi et al., 2015; Zimmo et al., 2017). Identifying these points could offer useful information on effective promotion strategies. Similarly, unlike the western literature, little information is available about sources used for health information (HI) seeking and the influence of these sources and information gained on adolescents' behaviour. Addressing this gap in knowledge remains a research priority in the EMR region, where there is a knowledge-action gap and insufficient progress towards evidence-based strategies and action plans for increasing PA (World Health Organization, 2019). Moreover, such evidence could expand the opportunities for intervention programmes aiming at promoting PA and input into public health efforts to curb the growing burden of non-communicable diseases (World Health Organization, 2019) in Qatar and other Arab countries with a similar context.

We aimed to assess the influence of information obtained from different sources on physical activity (PA) behaviour change and identified possible correlates of this change among the Qatari adolescent population in the state of Qatar. Our hypothesis suggests that seeking HI is a common behaviour among Qatari adolescents, consistent with existing literature on adolescents in general (Armstrong et al., 2021; Martinović et al., 2023; Neumark et al., 2013; Park & Kwon, 2018; Plaisime et al., 2020; Wartella et al., 2016). Online platforms and interpersonal sources of information are the main sources used by adolescents (Esmaeilzadeh et al., 2018; Freeman et al., 2020; Gulec et al., 2022; Martinović et al., 2023; Wartella et al., 2016). We further hypothesis that these sources exhibit a significant and positive correlation with their attempt to change fitness and exercise behaviour. Based on prior research, our hypothesis also suggests that older adolescents, female gender, higher body mass index (BMI), and dissatisfaction with body shape are negatively associated with fitness and exercise behaviour change (Liangruenrom et al., 2019). Moreover, we suggest that low levels of self-efficacy (SE), high levels of psychological distress (PSD), and previous traumatic experiences exert a negative influence on the attempt to change behaviour related to fitness and exercise (will be referred to PA throughout this paper) (Gu, 2022; Wang et al., 2023; Zou et al., 2023).

Methods

Study design

This is a secondary analysis of data from a nationally representative cross-sectional survey conducted by the Social and Economic Survey Research Institute (SESRI) – Qatar University from April 22 through 17 May 2017, among 1050 Qatari students aged 13–19 years representing both genders. This survey selected a nationally representative sample through a random systematic stratified sampling approach. Non-Qatari students, Qatari students with intellectual disabilities, those who do not speak or read Arabic, and those who refused to give consent/assent were excluded. More details about the sampling design and other information are provided in Supplementary Method.

Measures and definitions

A detailed description of the construction of variables used in this research is outlined in Supplementary Table S1.

Outcome of interest

Adolescents' attempt to change behaviour related to PA as a result of finding HI was the main binary outcome in this study. It was measured using the following question: 'Have the changes you just mentioned been related to any of the following health topics?' (the list of topics included PA). Adolescents who indicated that changes were related to other behaviours in the list of topics and those who did not try to change any health behaviour were considered not attempting to change their behaviour related to PA.

Main exposure of interest

The main exposure variables were four HI sources used by the adolescents mainly to change their behaviours. These sources encompassed interpersonal, online, traditional, and social media sources. Supplementary Figure S1 presents detailed information about each individual source used to define the main exposure. Adolescents were prompted for this information only when they indicated using the specific source for any reason.

Other covariates

Other covariates included age, sex, BMI, body shape satisfaction, decisional balance, SE, PSD, reported traumatic events, maltreatment, and victimization (Supplementary Table S1). Previous studies found that these covariates affect the pattern of health-related behaviours, such as PA, dietary habits, tobacco use, and alcohol consumption (Nunes et al., 2017; Saller & Khaled, 2019).

Data analysis

Characteristics of the participants were compared using appropriate parametric or non-parametric tests for continuous data. For categorical data, the Chi-square ($\chi 2$) test was used. Internal consistency reliability of psychometrics scales was assessed using Cronbach's alpha.

The association between the outcome and the four exposure variables was assessed using univariate and multivariable logistic regression. After adjusting for other covariates, the main exposure variables were kept in the model during model building using the purposeful selection method, following Hosmer and Lemeshow's model building procedures (Hosmer et al., 2013). Calibration and discrimination of the resulting final model were assessed using summary measures of goodness of fit (Archer & Lemeshow, 2006).

Crude and adjusted Odds Ratios (OR, aOR) and average marginal effects (AME) with accompanying 95% confidence intervals (CIs) were reported. When fitting models, multiple imputations by chained equations (MICE) were performed to impute missing values in the outcome variable (before categorization), exposure variables, and other covariates except for age. Analysis was conducted using the Stata software version 14.2 using procedures to handle complex survey data. Data were weighted using post-survey adjustments to account for survey design (StataCorp, 2015). All tests were two-sided, and statistical significance was set at a p-value <0.05.

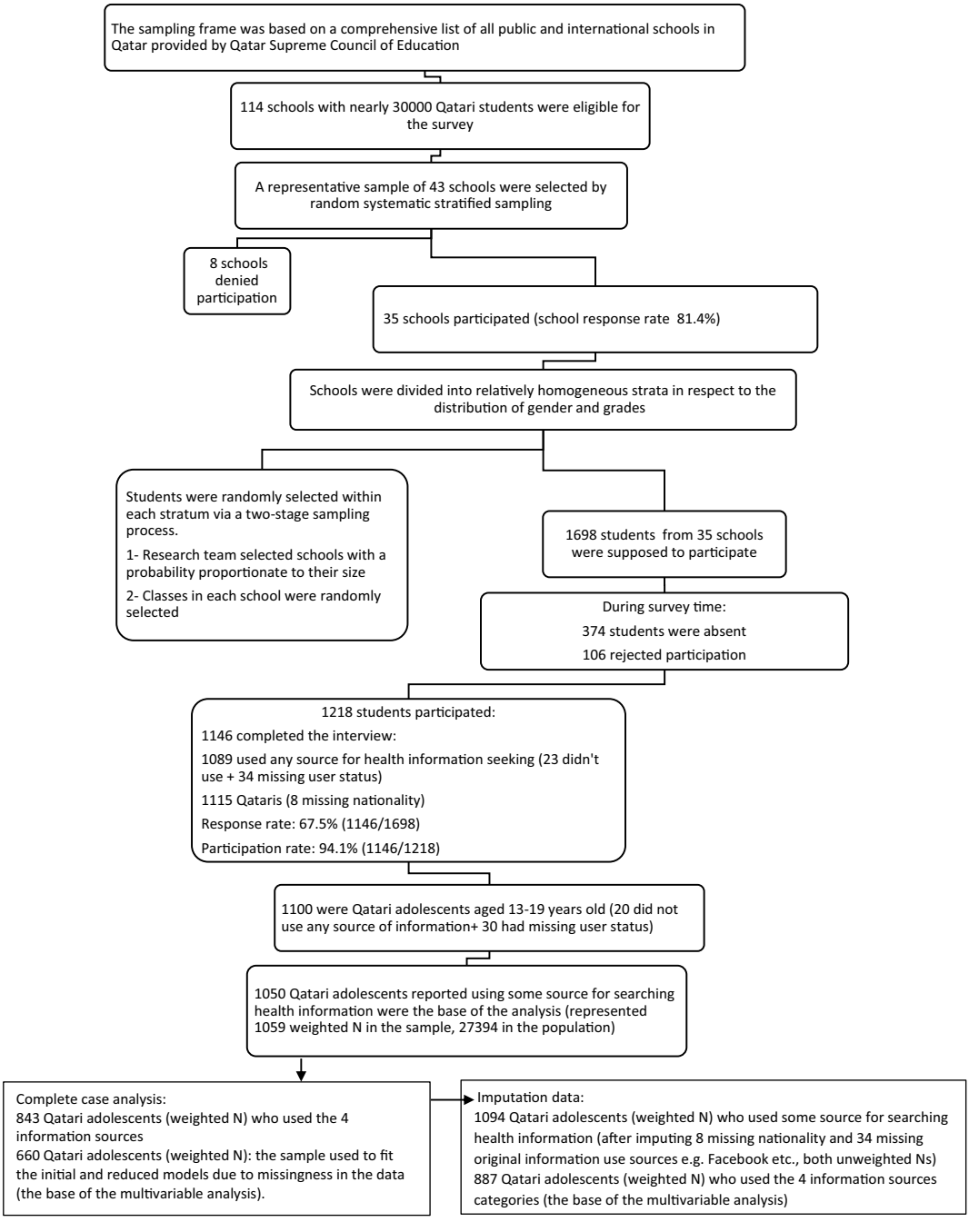

Figure 1. Sampling of study population.

Results

Respondents' characteristics

A total of 1050 adolescents were eligible and included in our study (Figure 1). The mean age was 15.72 (SD 1.43) years; about half were late adolescents (aged 16–19 years) (55%), nearly

half were females (52%), and about one-fifth were overweight (18% females, 20% males) (Table 1). About 45% of adolescents expressed their dissatisfaction with their body shape. Eighty-nine percent of adolescents reported PA is 'somewhat to very important' to them personally, and 78% reported it is 'somewhat to a lot important' for their friends. Most adolescents (59%) had moderate to high PSD (Cronbach's alpha value of 0.91), and 47% had high SE (Cronbach's alpha value of 0.98). A high proportion of adolescents (79%) indicated they suffered from traumatic events.

Attempted to change PA behaviour

Sixty-eight percent of the total study sample attempted to change PA behaviour (Table 1).

Use of information sources

The use of information sources for any reason was common: interpersonal sources (97%), traditional sources (93%), social media (92%), and online (88%). Parents and friends were the sources most used, and Facebook was the least (Supplementary Figure S1). In terms of sources adolescents used to

Table 1. Characteristics of adolescents.

Characteristics	Unweighted N 1050	Unweighted %	Weighted N 1058.7	Weighted %
Age in Years				
Mean (SD)	15.80 (1.43)		15.72 (1.43)	
13	49	4.7%	52.2	4.9%
14	169	16.1%	183.4	17.3%
15	218	20.8%	241.1	22.8%
16	272	25.9%	260.7	24.6%
17	221	21.1%	202.5	19.1%
18	90	8.6%	91.0	8.6%
19	31	3.0%	27.8	2.6%
Age Categories				
Early Adolescence(13–15)	436	41.5%	476.6	45.0%
Late Adolescence (16–19)	614	58.5%	582	55.0%
Sex				
Female	569	54.2%	546.8	51.7%
Male	477	45.4%	508.7	48.1%
Missing	4	0.4%	3.2	0.3%
School Grade				
Grade 8	191	18.2%	194.7	18.4%
Grade 9	184	17.5%	180.4	17.0%
Grade 10	268	25.5%	302.5	28.6%
Grade 11	215	20.5%	208.5	19.7%
Grade 12	159	15.1%	141.8	13.4%
Missing	33	3.1%	30.8	2.9%
School Grade Categories				
Junior Level (8–9)	375	36.9%	375.1	35.4%
Senior Level (10–12)	642	63.1%	652.8	61.7%
Missing	33	3.1%	30.8	2.9%
Height				
Mean (SD)	162.31(10.57)		62.43(10.7)	
Missing	43	4.1%	44.9	4.2%
Weight				
Mean (SD)	63.96 (21.60)		64.69 (21.49)	
Missing	47	4.5%	53.0	5.0%
BMI				
Mean (SD)	24.22 (7.38)		24.61(8.44)	
Missing	72	6.9%	78.1	7.4%

(*Continued*)

Table 1. (Continued).

Characteristics	Unweighted N 1050	Unweighted %	Weighted N 1058.7	Weighted %
BMI-WHO Criteria				
Underweight	122	11.6%	117	11.0%
Normal Weight	476	45.3%	469	44.3%
Overweight	208	19.8%	203.7	19.2%
Obese	172	16.4%	190.9	18.0%
Missing	72	6.9%	78.1	7.4%
Importance of PA to You				
Not at all important	36	3.4%	38.7	3.7%
Not too important	57	5.4%	62.3	5.9%
Somewhat important	307	29.2%	322.5	30.5%
Very important	632	60.2%	618.1	58.4%
Missing	18	1.7%	17.1	1.6%
Importance of PA to Friend				
Not at all	59	5.6%	64.0	6.0%
Only a little	79	7.5%	77.1	7.3%
Somewhat	280	26.7%	287.9	27.2%
A lot	536	51.1%	533.3	50.4%
Missing	96	9.1%	96.4	9.1%
NGSE Scale				
Mean (SD)	24.90 (11.68)		24.86(11.56)	
Missing	55	5.2%	57.9	5.5%
NGSE Category*				
Low	477	45.4%	481.9	45.5%
High	508	49.3%	518.9	49.0%
Missing	55	5.2%	57.9	5.5%
K6-Scale				
Mean (SD)	12.21 (7.11)		11.99 (7.15)	
Missing	59	5.6%	59.1	5.6%
Psychological Distress (Tertials of K6-Scale)				
Low	351	35.4%	371.4	35.1%
Moderate	325	32.8%	313.9	29.7%
High	315	31.8%	314.2	29.7%
Missing	59	5.6%	59.1	5.6%
Trauma Experience				
Yes	834	79.4%	838.8	79.2%
No	165	15.7%	167	15.8%
Missing	51	4.9%	52.9	5.0%
Sent Away				
Yes	232	22.1%	228.6	21.6%
No	715	68.1%	724.4	68.4%
Missing	103	9.8%	105.6	10.0%
Beaten Up				
Yes	366	34.9%	365.6	34.5%
No	557	53.1%	565.3	53.4%
Missing	127	12.1%	127.7	12.1%
Abused				
Yes	405	38.6%	414	39.1%
No	482	45.9%	474.1	44.8%
Missing	163	15.5%	170.7	16.1%
Body Shape Satisfaction				
Strongly disagree	262	25.0%	265.6	25.1%
Somewhat disagree	208	19.8%	213	20.1%
Somewhat agree	219	20.9%	218.5	20.6%
Strongly Agree	276	26.3%	275.1	26.0%
Missing	85	8.1%	86.5	8.2%
Sources Used for any reason:				
Interpersonal				
No	26	2.5%	28.2	2.7%
Yes	1014	96.6%	1021.1	96.5%
Missing	10	1.0%	9.4	0.9%
Traditional				
No	61	5.8%	64.3	6.1%
Yes	979	93.2%	985.6	93.1%
Missing	10	1.0%	8.72	0.8%

(*Continued*)

Table 1. (Continued).

Characteristics	Unweighted N 1050	Unweighted %	Weighted N 1058.7	Weighted %
Online				
No	114	10.9%	113.2	10.7%
Yes	920	87.6%	931.9	88.0%
Missing	16	1.5%	13.6	1.3%
Social Media				
No	66	6.3%	66.8	6.3%
Yes	969	92.3%	977.6	92.4%
Missing	15	1.4%	14.2	1.3%
Sources Used Mainly to Change Behaviour:				
Interpersonal				
Yes	882	84.0%	880.3	83.2%
No	103	9.8%	110.1	10.4%
Missing	65	6.5%	68.3	6.5%
Traditional				
Yes	754	71.8%	750.2	70.9%
No	196	18.7%	208.9	19.7%
Missing	100	9.5%	99.5	9.4%
Online				
Yes	652	62.1%	669.2	63.2%
No	247	23.5%	241	22.8%
Missing	151	14.4%	148.5	14.0%
Social Media				
Yes	714	68.0%	724.6	68.5%
No	234	22.3%	230.6	21.8%
Missing	102	9.7%	103.4	9.8%
Attempt to Change any Behaviours				
Yes	946	90.1%	949.8	89.7%
PA	733	77.5%	724.2	68.4%
Other Behaviour	184	19.5%	199.2	18.8%
Missing	29	2.8%	26.4	2.5%
No	81	7.7%	84.2	8.0%
Missing	23	2.2%	24.7	2.3%
Attempt to Change PA Behaviour				
Yes	733	77.5%	724.2	68.4%
No	265	27.2%	283.4	26.8%
Missing	52	5.0%	51.1	4.8%

SD: Standard Deviation; BMI: Body Mass Index; WHO: World Health Organization; PA: Physical Activity; K6: *Kessler Psychological Distress Scale-6;* NGSE: New General Self-Efficacy.
*NGSE scales split at median according to (Schwarzer, 2005)).

change their behaviour, about five out of six adolescents reported using interpersonal sources (83%), followed by traditional sources (71%), social media (69%), and online (63%) (Table 1).

Missing data

As all variables except age had missing values (Table 1), around 22% of our sample was excluded from the complete case analysis due to missingness. The missing data pattern showed that missingness was scattered, with no specific patterns, thus we assumed that data were missing at random.

Crude analysis

Adolescents' attempts to change PA behaviour based on information found via interpersonal, traditional, online and social media sources accounted for 80%, 80%, 82%, and 81%, respectively (Table 2). Adolescents who attempted PA change were mainly in the late adolescence stage (76%), considered PA somewhat/very important (74%), had experienced traumatic events (74%), maltreatment (76%), or were victimized (75%) (Table 2).

Table 2. Association between sources used to change behaviour and other covariates with attempt to change PA behaviour (weighted $N = 1058.7$).

Characteristics	Attempt N (%)*	No Attempt N (%)*	*P* Value**
Sources Used Mainly to Change Behaviour			
Interpersonal ($N = 969.2$)			<0.0001
No	22.2 (20.2%)	87.9 (79.8%)	
Yes	685.6 (79.8%)	173.5 (20.2%)	
Traditional ($N = 935.4$)			<0.0001
No	104 (50.1%)	103.6 (50.6%)	
Yes	581.9 (80.0%)	145.9 (20.0%)	
Online ($N = 891$)			<0.0001
No	117 (49.5%)	119.6 (50.6%)	
Yes	536.3 (82.0%)	118.1 (18.1%)	
Social Media ($N = 935.8$)			<0.0001
No	115.9 (51.0%)	111.5 (49.0%)	
Yes	571.2 (80.6%)	137.2 (19.4%)	
Sex ($N = 1004.5$)			
Female	390.7 (73.9%)	137.8 (26.1%)	0.269
Male	331 (69.5%)	145 (30.5%)	
Age ($N = 1007.6$)			0.004
Early Adolescence (13-15ys)	304.1 (66.6%)	152.4 (33.4%)	
Late Adolescence (16-19ys)	420.1 (76.2%)	131 (23.8%)	
School Grade ($N = 978.6$)			0.007
Junior Level (8–9)	240.2 (66.5%)	12.9 (33.5%)	
Senior Level (10–12)	465 (75.3%)	152.5 (24.7%)	
BMI ($N = 934.2$)			0.963
Underweight	83 (72.9%)	30.9 (27.1%)	
Normal	320.6 (72.2%)	123.6 (27.8%)	
Overweight/Obese	274.4 (73.0%)	101.7 (27.0%)	
Importance of PA-You ($N = 993.4$)			0.009
Not at all/Not too important	56.5 (59.4%)	38.7 (40.7%)	
Somewhat/Very important	66.8 (73.6%)	237.4 (26.4%)	
Importance of PA- Friend ($N = 920.7$)			0.307
Not at All/Only a little	92.5 (68.8%)	41.9 (31.2%)	
Somewhat/A lot	580.7 (73.9%)	205.6 (26.2%)	
NGSE ($N = 972$)			0.069
Low	317.7 (68.6%)	145.2 (31.4%)	
High	382.6 (75.2%)	126.5 (24.9%)	
Psychological Distress ($N = 971.2$)			0.596
Low	252.5 (70.1%)	107.9 (30.0%)	
Moderate	226.8 (74.2%)	79.0 (25.8%)	
High	219.5 (72.0%)	85.5 (28.0%)	
Trauma Experience ($N = 976.6$)			0.021
No	98.7 (62.6%)	58.9 (37.4%)	
Yes	607.2 (74.1%)	211.8 (25.9%)	
Maltreatment ($N = 947.9$)			0.004
No	276 (67.6%)	132.6 (32.5%)	
Yes	410.4 (76.1%)	128.9 (23.9%)	
Victimization ($N = 925.1$)			0.015
No	286.4 (69.0%)	128.9 (31.0%)	
Yes	385.2 (75.6%)	124.6 (24.4%)	
Body Shape Satisfaction ($N = 942.1$)			0.946
Not Satisfied	332.4 (72.2%)	128.1 (27.8%)	
Satisfied	349.1 (72.5%)	132.5 (27.5%)	

*Weighted count and percentages. N's not add up to the weighted 1058.7 due to missingness. ** Design-based Chi-square tests P-value. PA: Physical Activity; BMI: Body Mass Index; NGSE: New General Self-Efficacy.

Adjusted analysis

Effective sample sizes used in multivariable analyses are shown in Figure 1. After adjusting for other covariates, and imputation, our results showed that using information from interpersonal (aOR: 9.35, 95% CI: 4.15–21.08, $P < 0.001$) and online (aOR: 2.53, 95% CI: 1.50–4.27, $P = 0.001$) sources to try to change PA behaviour, late adolescence (aOR: 2.17, 95% CI: 1.37–3.44, $P = 0.002$) and considering PA

Table 3. Multivariable logistic regression analysis for the attempt to change PA with average marginal effects for the probability of attempting PA change. (imputed data: final model, number of imputations = 20, $N = 887$).

Variables	aOR*	*P* Value†	AME⁋	*P* Value**
Sources Used Mainly to Change Behaviour:				
Interpersonal				
No	1			
Yes	9.35 (4.15–21.08)	<.001	0.46 (0.29–0.62)	<0.001
Online				
No	1			
Yes	2.53 (1.50–4.27)	0.001	0.16 (0.06-0.26)	0.004
Social Media				
No	1			
Yes	1.55 (0.92–2.61)	0.094	0.07 (−0.02-0.16)	0.123
Traditional				
No	1			
Yes	1.07 (0.65–1.76)	0.796	0.01 (−0.06-0.08)	0.794
Age				
Early Adolescence (13–15)	1			
Late Adolescence (16–19)	2.17(1.37–3.44)	0.002	0.11 (0.04-0.18)	0.003
Importance of PA				
Not at all/Not too important	1			
Somewhat/A lot important	2.34 (1.13–4.84)	0.023	0.14 (0.01-0.28)	0.042
Sex				
Female	1			
Male	0.65 (0.38–1.11)	0.107	−0.06(−0.14-0.01)	0.104

*Adjusted Odds Ratio for the covariates in the table. ⁋Results were adjusted for complex survey design and model covariates (imputed data, N=887).†Wald test p-value**t Statistics p-valueThe overall model significance F (7, 28.6) = 23.17, P<0.0001.AME: Average Marginal Effects (Risk Differences). PA: Physical Activity. CI: Confidence Interval.

important (aOR: 2.34, 95% CI: 1.13–4.84, $P = 0.023$) were significantly associated with the attempt to change PA behaviour (Table 3).

For sex, by contrast, the significant negative association between males and the attempt to change PA in complete-case analysis became insignificant in the imputed data after adjusting for other covariates. However, the magnitude and direction of the association remained similar (aOR: 0.65, 95% CI: 0.38–1.11, $P = 0.107$). We retained sex in the model independently of its association because it is documented to be among factors that affect patterns of health-related behaviours and to account for socio-cultural norms that imposed certain restrictions on Arab females in the context of PA.

As shown in Table 3, the expected difference in probability of an attempt to change PA associated with using information from interpersonal sources to change behaviour is about a 46% point increase (95% CI: 29%-62%, $P < 0.001$). This means, on average, the probability of attempting PA change behaviour among adolescents who used these sources to change their behaviour was 46% points higher than those who did not, controlling for other covariates in the model. Likewise, the probability of attempting PA change among adolescents who used online sources was 16% (95% CI: 6%-26%, $P = 0.004$) higher than it was for those who did not, adjusting for other variables in the model. Older adolescents and those who considered PA important on average had 11% (95% CI: 4%-18%, $P = 0.003$) and 14% (95% CI: 1%-28%, $P = 0.042$) higher probability of attempting PA change as compared to younger and those who did not consider PA important, respectively.

Multivariable logistic regression models using complete case analysis are included in Supplementary Table S2.

Discussion

The current study found that health information-seeking behaviour was common among Qatari adolescents, as anticipated and in line with previous studies (Armstrong et al., 2021; Martinović et al.,

2023; Neumark et al., 2013; Park & Kwon, 2018; Plaisime et al., 2020; Wartella et al., 2016). We also found a significant association between the adolescents' attempt to change their PA behaviour and HI obtained from interpersonal and online sources. These sources predicted the attempt better than other sources, showing sizable average marginal effects.

Interpersonal sources are widely used by adolescents to obtain HI (Esmaeilzadeh et al., 2018; Martinović et al., 2023; Wartella et al., 2016). In our data, interpersonal sources topped the other three sources and more than two thirds of teens attempted PA change based on information from these sources. Consistent findings from different reviews and studies (Kiyani et al., 2021; Liangruenrom et al., 2019; Lisinskiene & Juskeliene, 2019; Martins et al., 2017; Nunes et al., 2017) acknowledged interpersonal relationships as important predictors of adolescents' PA. Significant others such as parents, siblings, friends, teachers and health professionals are more trusted sources for HI (Freeman et al., 2020). They play an important role in a person's behaviour and provide adolescents with information, motivation, emotional, tangible, and other kinds of support, or act as a role model which facilitate their involvement in sports and PA behaviour (Kiyani et al., 2021; Liangruenrom et al., 2019; Lisinskiene & Juskeliene, 2019).

Adolescents in Qatar enjoy healthy and strong interpersonal relationships, with nearly 94% having a good relationship with their parents and teachers and around 83% reporting no conflict with their peers (Al-Kaabi et al., 2017). The findings from our study and other studies highlight the importance teens attached to interpersonal sources across different cultures and reflect the extent to which they are considered credible and trustworthy. This could explain the significant association found in our analysis. Therefore, involving these agents in health education and promotion intervention programmes targeting PA could improve intervention outcomes.

The Internet is considered by far the most popular source of HI among adolescents (Esmaeilzadeh et al., 2018; Freeman et al., 2020; Gulec et al., 2022; Wartella et al., 2016) as it affords privacy and anonymity and is characterized by accessibility and availability of information. Internet is widely accessible in Qatar, which is facilitated by mobile devices. Accordingly, it was not surprising to find that majority of the teens in this study reported using online sources to seek HI. The information found from these sources was significantly associated with adolescents' attempts to change their PA behaviour in this study, with half of all adolescents reporting doing so as a result of this information. This influence was documented in other studies. Systematic reviews demonstrated that the Internet could be a successful platform for delivering tailored interventions to elicit behaviour change among teens and foster the success of such interventions or health campaigns (Crutzen et al., 2011; Freeman et al., 2020). The reviews also showed that online HI, especially reliable ones, can promote positive beliefs and could be used to change adolescents' health behaviour (Crutzen et al., 2011; Freeman et al., 2020). In agreement, Wartella et al. found that one-third of online HI users changed their behaviour because of what they found, and 15% of all teens particularly changed PA behaviour (Wartella et al., 2016). Ethnic differences were observed between Hispanics, Blacks and Whites with nearly 42%, 40%, and 29% respectively, acknowledged changing their behaviour based on their online findings (Wartella et al., 2016). This demographic and cultural variation can explain the higher prevalence in our study.

Adolescents' interest in receiving HI through social media and the impact of this source on health behaviour have been documented (Freeman et al., 2020; Goodyear et al., 2019; Plaisime et al., 2020). In our study, half of the participants reported attempting to modify their PA behaviour as a result of social media information, but with marginal statistical significance in the multivariable imputed model. Social media is a popular medium of interaction, communication, and self-presentation and not solely used for HI seeking. Yet if the information obtained from this source is trusted, it could predict the adolescent's future health behaviour (Freeman et al., 2020). However, it was found that adolescents considered these sources less trustworthy as compared to websites and expressed concerns over confidentiality, misinformation, and cyberbullying (Freeman et al., 2020; Plaisime et al., 2020). In addition, their judgement on the trustworthiness of a post or information and their choice to act upon that information is informed by the number of likes, followers and distinctive

features of social media influencers (Goodyear et al., 2019; Lajnef, 2023). Using such criteria to gauge the credibility of information is not a guarantee for making safe or healthy choices.

Overall, this source has a lot of promise as a health promoting tool, but existing challenges need to be addressed to make the most of its potential.

Similarly, while traditional sources were used by adolescents in this study, they did not show a significant association with adolescents' attempts to change PA behaviour. Some studies found that these sources were less often used by adolescents for HI (Esmaeilzadeh et al., 2018; Martinović et al., 2023). They were used for entertainment, school projects, and general knowledge. Adolescents considered these sources unidirectional, less updated, and not amenable to interaction or control over the information provided as compared to other sources (Freeman et al., 2020). In addition, their time is more occupied by digital media, and with the change in technology they can obtain information easily from other sources (Freeman et al., 2020).

In this study, students in late adolescence had higher odds of attempting PA behaviour changes than their younger peers. This finding was consistent with the systematic review of Uijtdewilligen et al. (2011). However, it contradicts other findings, in which participation in PA decreased with adolescents age (Liangruenrom et al., 2019; Martins et al., 2017) or showed no significant association (Kiyani et al., 2021).

Our findings could be interpreted in several ways. First, older adolescents may be more aware of PA's importance for their body and health than their younger peers. Second, given that the ability to exercise was suggested to be a major drive for voluntary PA, older adolescents, whose capabilities are well developed in many aspects (e.g. physical, motor, cognitive), can meet most sports and exercise demands (Brown et al., 2017), hence are more interested in being more active. Generally, our findings and those from other studies may imply that age-based intervention strategies are important to effectively promote PA behaviour.

Our study found that adolescents' PA's personal importance was significant predictor of attempting this behaviour change. The literature documented that increasing numbers of teens became interested in seeking fitness or PA related information online (Martinović et al., 2023; Park & Kwon, 2018; Plaisime et al., 2020; Wartella et al., 2016). Theoretically, it was suggested that when the value of a behaviour is identified, such as identifying with the importance of PA for well-being, its regulation will be more fully internalized (Deci & Ryan, 2000). As such, the behaviour would be accompanied by more commitment and performance, and is expected to be maintained (Deci & Ryan, 2000).

Gender has consistently been reported as one of the correlates of PA in adolescents (Liangruenrom et al., 2019; Martins et al., 2017). Females in our study had higher odds of attempting to change PA behaviour than males. This finding, although intriguing, did not show statistical significance. One possible explanation for this finding could be that girls may engage in PA with the intention to become more active. However, their participation might be hindered by the fact that the available options do not align with their preferences, capabilities, or personal concepts of femininity, or enjoyment (Whitehead & Biddle, 2008). To the barriers mentioned above, one could add factors such as lack of support, socio-cultural norms that imposed certain restrictions on Arab females in the context of PA, and the acceptance of dictated norms that prioritize social involvement over PA (Sharara et al., 2018). Further work is needed to understand better PA perception of Arab female adolescents in this socio-cultural context.

Results in the literature about BMI and body shape satisfaction were inconclusive. While the current study did not find any statistically significant association between BMI or body shape satisfaction and the attempt to change PA, research suggested either an inexistent or inconsistent association between PA and BMI (Liangruenrom et al., 2019; Zimmo et al., 2017) and body image perception (Gualdi-Russo et al., 2022). Some evidence supported negative association between PA and body image dissatisfaction (Gualdi-Russo et al., 2022; Liangruenrom et al., 2019).Another systematic review by Nunes et al. (2017) found an association between physical inactivity and overweight and underweight. Heterogeneity in participants, methodology, outcome measures, and cultural context may lead to these dissimilarities.

As per SE, although literature findings considered it a key determinant of PA among adolescents (Dishman et al., 2019; Lisinskiene & Juskeliene, 2019; Martins et al., 2017; Zou et al., 2023), we could not obtain this relation in our sample. While higher odds of an attempt to change PA behaviour were found among highly efficacious teens in our study, the results did not reach statistical significance in the multivariable analysis. Further, SE was neither a confounder nor an effect modifier during model-building steps in the context of our data. Alert et al (Alert et al., 2018) did not find SE to be a significant correlate for PA among Hispanic adolescents at two-year follow up, although it was at the baseline, and suggested that SE is not a predictor for PA.

Almost two-thirds of Qatari adolescents in our study had moderate to high PSD. Al-Kaabi et al. (2017) have previously reported a depression prevalence of nearly 35% in this population. Adolescents experience a higher prevalence of PSD compared to the general population with significant proportion of teens across various countries encounter PSD to a considerable degree as literature indicated (Gu, 2022; Li et al., 2021).

Results of previous studies on the association between PA and PSD in teens have been inconsistence. For instance, Li et al. (2021) and Jiafeng Gu (2022) reported a negative association between self-reported PA and PSD. According to both studies, appropriate PA showed potentials to serve as an effective approach in preventing or mitigating PSD among adolescents (Gu, 2022; Li et al., 2021). Another study found that change in objectively measured PA showed no significant longitudinal association with change in PSD (Opdal et al., 2019). Discrepancies in methodology and the influence of other moderators may attribute to this difference (Gu, 2022; Opdal et al., 2019).

Adverse traumatic experience was not a significant correlate in our model despite being a positive significant potential correlate in univariate analysis. Using exercise as a stress-coping mechanism can explain this positive relation. Moreover, it is noteworthy that more than half of the youth in the current study reported being maltreated. This culturally sensitive issue has been previously tapped (Al-Kaabi et al., 2017). Posttraumatic stress symptoms associated with high level of PA as reported by Peltzer and Pengpid (Peltzer & Pengpid, 2019). In contrary, findings from a systematic review (Wang et al., 2023), included studies among adolescents and adults, showed an inverse relationship between regular PA and post-traumatic disorder after stressful events. The review indicated the potential for PA to mitigate negative impact of adverse traumatic experience on mental health prior and after these events.

Strengths and limitations

This study is one of the first to examine the attempt to change PA behaviour concerning HI sources in the presence of other important correlates. Unlike other studies which focused on limited number of sources, it included a wide range of sources combined under specific categories. It went beyond descriptive nature and univariate analysis to explore the link between behaviour change and information obtained from each source while considering the potential effect of other sources and different correlates.

Another notable strength of our study is the large sample size, notable for its national representativeness. To obtain valid results, our study handled missing data using a sophisticated method (multiple imputations). Besides, we estimated average marginal effects from the logistic regression model results, considering the complex sampling design while adjusting for covariate distribution differences between the groups. By doing this, we could present results as differences in marginal probabilities or risk differences, which are more informative than ORs and relative risks. These measures are important in public health as they indicate the potential for prevention. Further, the study also sheds light on some psychosocially and culturally sensitive issues among adolescents that warrant further research.

However, the study also has some limitations. First, this study is cross-sectional, as most of the studies in this field, thus, the temporality assumption is difficult to be assured. The study relied on self-report through questionnaires which makes PA and other reported variables prone to error and bias, such as recall bias and social desirability. Teens may not accurately report or recall their information seeking behaviour and the influence of information obtained on their health behaviour

(Wartella et al., 2016). On the other hand, given the relative anonymity of internet searches and the common practice of searching the Internet, the problem of bias in this regard may not pose a major threat to the validity of our results and other similar studies (Neumark et al., 2013).

In addition, the study used secondary data from a complex survey design; this complexity put some hurdles to some statistical analysis.

Further, though items of the current survey were extracted from a validated questionnaire, the attempt to change PA was measured by a single-item question that was not specific. The SE measure used in this study was not PA specific measure. These constructs could be measured more deeply with other specific validated instruments in the literature. One limitation to the generalizability of the findings to all adolescents in the country is the exclusion of adolescents from other nationalities. However, given that adolescents in this study seemed similar to many teenagers in the country and the region, it is reasonable to expect that results may be generalizable to youth in Qatar and neighbouring countries with similar contexts.

Conclusion

This study contributes valuable insights to the existing body of literature and holds the potential to provide guidance for the development of intervention programmes for adolescents. The current study provides insights into how adolescents interpret and integrate health information from various sources into their behaviour. The results lend more support to the role of interpersonal and online sources in promoting teens' behaviour change of both sexes. In addition, they emphasize the importance of adopting a multifaceted approach to disseminate HI to adolescents, improve Internet literacy and searching skills to empower our teens to properly find, appraise and process online HI. The findings also reveal that age and personal value of PA influence the initiation of behaviour change. It is imperative to develop health promotion and education programmes that highlight the benefit and importance of PA behaviour to youth, stressing the meaning and relevance of such behaviour to enhance value identification and make adaptive behaviour change possible. In the same time, interventions should be age- and gender-sensitive, designed on cultural beliefs and practices and integrate socially acceptable yet enjoyable activities to address the disparities.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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