ORIGINAL ARTICLE

Health-Related Quality of Life and its Determinants among School-going Adolescents: A Cross-sectional Study

Ranjeeta Kumari[1], MBBS, MD; Aswani Kumar Seth[2], MBBS, MD; Yogesh Singh[3], MBBS, MD; Nisarg Aravindan[4], MBBS; Bhola Nath[2], MBBS, MD

[1]Department of Community and Family Medicine, All India Institute of Medical Sciences Rishikesh, Rishikesh, India;
[2]Department of Community and Family Medicine, All India Institute of Medical Sciences Raebareli, Raebareli, India;
[3]Department of Physiology, All India Institute of Medical Sciences Rishikesh, Rishikesh, India;
[4]ICMR Centre for Outbreak Science, Indian Council of Medical Research- National Institute of Epidemiology (ICMR-NIE), Chennai, India

Corresponding Author:
Bhola Nath, MBBS, MD; Department of Community and Family Medicine, All India Institute of Medical Sciences, Postal code: 229405, Raebareli, Raebareli, India
Tel/Fax: +91 53 52704409; **Email:** bholanath2001@gmail.com

ABSTRACT

Background: Adolescents experience rapid physical, cognitive, and psychosocial growth in their transition from childhood to adulthood, affecting health outcomes and well-being. Health-related quality of life (HRQoL) is a useful indicator of health outcomes, assessed in the current study along with associated determinants.

Methods: A cross-sectional study was conducted among 634 randomly selected adolescents from 13 randomly selected schools in Gharwal division, Uttarakhand, India, from August 2019 to September 2020. The students studying in the 8th-11th standard and those providing assent and consent from their parents were included in the study. They were screened using the short version of the Physical Activity Readiness Questionnaire. Along with physical activity and fitness assessment, the Global School-based Student Health Survey questionnaire was administered. The transformed HRQoL domain scores were calculated using the WHOQOL-BREF questionnaire. A univariate and multivariable linear regression model was applied to identify the determinants of HRQoL using SPSS version 23.

Results: The study included 324 (51.1%) boys and 310 (48.9%) girls. The mean age of the students was 14.4±1.4 years. The highest mean score was 72.3±21.0 for the social relationship domain and the lowest was 55.6±15.0 for the physical domain. The age, parents using any form of tobacco, a history of ever-use of alcohol and physical fitness were significantly associated with HRQoL domain scores. The non-dominant back stretch test was also significantly associated (Beta coefficient; SE, P-value) with physical (-4.1; 1.4, 0.002), psychosocial (-3.9; 1.5, 0.010) and environmental (-3.5; 1.4, 0.014) domain scores.

Conclusion: All domains of HRQoL need to be improved and should address the psychological, social, and mental well-being of adolescents. Physical activity and fitness of students emerged as a strong modifiable predictor affecting almost all the domains of HRQoL, warranting its promotion in schools and the promotion of healthy behavior among parents and adolescents.

Keywords: Adolescents, Physical fitness, Quality of life, Substance abuse

Introduction

Adolescence, defined as a period between 10-19 years as defined by World Health Organization (WHO), is a period of transition from childhood to adulthood and is marked by changes in physical, emotional, social, mental, and psychosocial domains of development.[1] During adolescence, individuals are exposed to extrinsic and intrinsic factors that impact their health and may indeed be one of the causes of health inequalities later in life. Approximately 253 million adolescents out of 360 million in South Asia are in India, constituting 18% of the population in India.[2] In the coming years, this cohort is expected to contribute to the growth of the economy of the country and affect its health status. It is, therefore, essential to investigate and invest in the field of adolescents' health.

Based on the WHO definition of "health", it is not only somatic indicators that explain health but also the way a person feels both psychologically and physically, how he/she interacts or behaves in a community with other persons, and how well he/she copes with changes in everyday life.[3] Quality of life (QoL) is a step ahead and is defined as a subjective and comprehensive concept involving dynamic interaction between the external conditions of the individuals' lives and the perceptions towards these conditions.[4] Health is usually considered as the central domain of QoL surrounded by the importance of family, financial status, etc.[5] Health-related quality of life (HRQoL) is a construct that measures health comprehensively, as envisaged in the WHO definition of health. HRQoL is a multidimensional construct covering physical, emotional, mental, social, cultural, and behavioral components of well-being and functions as perceived by the individuals.[6, 7]

Adolescents are in a phase of transition from school to university, which is expected to influence their health and well-being. Measurement of HRQoL can help monitor, on a routine basis, the individuals' subjective health and well-being; screen for any impairments in their well-being and functions; and identify social and behavioral determinants of health among them. Regular measurement of HRQoL in children and adolescents can help identify subgroups with poor physical or mental health. Several studies in the past have assessed the HRQoL among adolescents suffering from diseases.[7-9] However, studies on the measurement of HRQoL of "normal" adolescents, who are also predisposed to psychological, emotional, and mental turmoil in day-to-day life, are lacking in India and more so in Uttarakhand, India, which is a hilly state in North India with its unique challenges in terms of accessibility to various services due to its geographical terrain. A thorough review of the literature found that only one study was conducted in another part of the country among normal healthy adolescents using the same tool for assessment.[10] Hence, there is insufficient data on baseline HRQoL among normal adolescents in Uttarakhand. Therefore, the present study aimed to assess the HRQoL and its determinants among school-going adolescents in government schools of the Garhwal division of Uttarakhand, India.

Materials and Methods

A cross-sectional study was conducted among school-going adolescents in government schools in the Garhwal division of Uttarakhand, India. Uttarakhand is one of the north Indian states comprising two divisions, namely Garhwal and Kumaon. The division of Garhwal has seven districts which are divided into three zones based on altitude viz: low, middle, and high altitude. This study is part of a larger survey conducted in this region among these participants.[11]

The study was conducted from August 2019 to September 2020 among 634 randomly selected school-going adolescents from 13 selected schools of the Garhwal division. A multistage stratified random sampling was performed to recruit the study participants. One district was randomly selected from each zone of the Garhwal division. Further, four blocks

were randomly selected from each district and one senior secondary school was selected from each block randomly. A minimum of 50 randomly selected students were selected from each school for participation in the study. A proportionate number of school-going boys and girls were selected from each school. Out of 12 schools randomly selected, one turned out to be an all-girl school. Hence, to maintain a proportionate sample of boys and girls, we selected the 13th school of boys from the same block near the all-girl school. The total number of participants recruited in the study was estimated using the Number of students in each school (i.e., 50) x No of schools in each district (i.e., 4) x Number of districts (i.e.,3), which was equal to 600. Considering a non-response rate of 5%, 634 participants were recruited. The number of districts to be selected, schools to be selected, and students selected from each school were decided based on convenience and budgetary constraints upon discussion with the principal investigator and co-investigators.

All students studying in the 8th to 11th standard present in school on the day of data collection and those willing to participate were included in the study after obtaining their consent from their parents. The students suffering from any disease in which physical activity was contraindicated, those who were sick in the week before, or those students who responded positively to even one question of the short version of the Physical Activity Readiness Questionnaire were excluded.

An adapted structured questionnaire was used to obtain sociodemographic details. Global School-based Student Health Survey (GSHS) questionnaire was used to obtain information regarding dietary behavior, injury, abuse and mental health, feelings and friendship, tobacco use, alcohol and drug use, and experiences at school and home.[12] This questionnaire has ten core modules containing validated survey items. Only specific modules relevant to the present study were selected.

The students' physical activity was assessed using a modified version of the Physical Activity Questionnaire for Adolescents (PAQ-A), which has consistently high validity and moderate reliability.[13, 14] The questionnaire had acceptable internal consistency ($\alpha=0.72$) and test-retest reliability (ICC=0.78).[15] The modified version consisted of 13 activities relevant to Indian settings, and was used by other researchers in India.[16] The composite scores of the first nine items were taken and mean scores were obtained for each student, which ranged from one to five. A score of one indicated low physical activity and a score of five indicated high physical activity. Based on these scores, the participants were classified as active if they had a physical active level (PAL) score of three or more than three and sedentary if a PAL score was below three.[17]

The physical fitness was assessed by the Harvard step test,[18, 19] hand grip dynamometer test, and back-stretch test.[20] Camry electronic hand grip dynamometer was used for the hand grip test which classified the grip strength of males and females separately.[11, 21] Compared to the gold standard, the Camry electronic hand grip dynamometer had an ICC ranging between 0.815-0.854;[22] similarly, the Havard step test had an ICC>0.60.[23]

Assessment of the quality of life was done using a modified World Health Organisation Quality of Life- BREF (WHOQOL BREF) questionnaire. It has been validated among adolescents in Indian settings in various studies.[24, 25] It is divided into four domains: physical, psychosocial, social relationships, and environmental, and consists of a total of 26 items measuring the HRQoL among adolescents. The responses of all these items are scored using a 1-5 Likert scale. The scores obtained were transformed to a 0-100 scale as stated in the manual.[26] The questionnaire was culturally modified by replacing one item in the social domain. The question that was modified was "Are you satisfied with your sex life?" It was replaced with "Are you satisfied with the respect you receive from others?"[24] This is an instrument developed by WHO, with the help of 15 collaborating centres around the world, which makes it

suitable to be used in a variety of cultural settings. The physical domain raw score ranges from 7-35, psychological domain from 6-30, social relationship domain from 3-15, and the environment domain from 8-40. The ranges of raw score are different due to the difference in the number of questions in each domain. The WHOQOL instruments can be used cultural settings, and at the same time, the results are comparable across cultures. The instrument had good internal consistency having Cronbach's alpha of 0.87 as well as good content, construct and predictive validity (P<0.05).[24] Domains were scaled in a positive direction (i.e., higher scores denote higher quality of life). The permission to use the Hindi version of WHOQOL BREF was obtained from WHO.

The data was analysed using SPSS version 23.0 (SPSS Inc., Chicago II, USA). The domain score of WHOQOLBREF was reported as mean and standard deviation (SD). Missing data were handled as per the instructions in the WHOQOL BREF questionnaire manual. Univariate and multiple linear regression model was to identify the determinants affecting the HRQoL domain scores. The variables with a P-value less than 0.1 in the univariate linear regression model were included in the multiple linear regression model. The association was reported as beta coefficient (β) and standard error (SE). A P value less than 0.05 was considered significant. A correlation matrix was constructed by calculating Pearson's correlation coefficient among variables included in the multiple linear regression.

The study received ethical clearance from the ethics committee of the institute (AIIMS/IEC/19/803). An informed consent was obtained from the school principal, parents, and adolescents before data collection. The confidentiality of the data was maintained. The study was conducted based on the Indian Council of Medical Research guidelines in Human beings and adhered to principles of Good clinical practice and the Declaration of Helsinki.

RESULTS

A total of 634 (100%) school-going adolescents participated in the study. About 126 (19.9%) students were studying in the 8th standard, 177 (27.9%) in the 9th standard, 176 (27.8%) in the 10th standard, and 155 (24.4%) in the 11th standard. The mean±SD of students' age was 14.4±1.4 years. Of 634 students, 324 (51.1%) were boys and 310 (48.9%) were girls. The mean±SD of boys' and girls' age was 14.6±1.4 and 14.3±1.3 years, respectively. The students' mean±SD of family size was 6.2±2.5 members. About 54 (8.5%) and 120 (18.9) students had a father and mother with no formal education, respectively. The majority (379, 59.8%) of the student's fathers were self-employed, whereas 8.5% (534) of the student's mothers were self-employed.

The mean±SD transformed domain HRQoL scores obtained were 55.6±15.0 for the physical domain, 57.2±15.9 for the psychosocial domain, 72.3±21.0 for the social relationship domain, and 61.2±15.9 for the environmental domain (Table 1).

A high physical domain score (mean±SD) was obtained for students whose mother was employed (59.0±14.5), those with mothers having education above high school (58.9±19.6), and students who had used alcohol (57.8±12.0). A high psychosocial domain score (mean±SD) was obtained for students who had ever chewed tobacco (63.6±15.2) followed by those who had ever tried alcohol (63.1±16.7) and those who had never smoked tobacco (60.4±14.4). It is to be noted that the number of students who had ever consumed alcohol or had ever chewed tobacco was 5.8% and 2.8%, respectively). The social and environmental domain scores were almost equal for all the variables studied (Tables 1-3).

The univariate linear regression model was used to determine the association between the predictor variable and HRQoL scores and to identify the variables (P<0.100) to be included in the multivariable linear regression. Among baseline characteristics of the students, age was found to be a significant variable (Beta coefficient; SE) for physical (0.7; 0.4)

(P=0.077), psychosocial (1.2; 0.5) (P=0.054), and environmental (1.5; 0.5) (P=0.066) domain scores; the type of family was a significant variable for social relationship (-3.2; 1.8) (P=0.049) domain score, and mother's education was a significant variable for physical (-0.6;0.4) (P=0.065) and psychosocial (0.7; 0.4) (P=0.078) domain scores (Table 1).

Table 1: Relationship between baseline characteristics of the study participants and Health-Related Quality of Life domain scores

Variables	Category	Frequency (%)	Transformed domain scores (Mean±SD)			
			Physical	**Psychosocial**	**Social relationship**	**Environmental**
Gender	Boys	324 (51.1)	56.3±14.7	58.2±15.5	72.5±21.4	62.1±16.0
	Girls	310 (48.9)	54.8±15.4	56.2±16.3	72.1±20.7	60.2±15.8
	Beta coefficient (Standard Error)		-1.5 (1.2)	-2.0 (1.3)	-0.5 (1.7)	-1.9 (1.3)
	P value		0.823	0.112	0.145	0.186
Age (in years)	10-12 (Reference)	46 (7.3)	52.8±15.3	52.9±15.0	68.8±25.2	55.2±18.1
	13-15	451 (71.1)	55.5±14.9	56.9±16.1	72.6±20.5	61.1±15.9
	16-19	137 (21.6)	56.7±15.3	59.8±15.1	72.5±21.2	63.6±14.6
	Beta coefficient (Standard Error)		0.8(0.1) & 0.7 (0.4)	1.2 (0.5) & 1.4 (0.5)	0.9 (0.6) & 1.3 (0.4)	1.5 (0.5) & 1.8 (0.7)
	P value		0.080 & 0.077	0.054 & 0.060	0.111 & 0.491	0.066 & 0.068
Type of family	Nuclear	450 (71.0)	56.0±14.7	57.7±16.1	73.2±21.3	61.7±15.8
	Joint	184 (29.0)	54.5±14.7	56.2±15.4	70.1±20.3	60.1±16.3
	Beta coefficient (Standard Error)		-1.6 (1.3)	-1.5 (1.4)	-3.2 (1.8)	-1.6 (1.4)
	P value		0.256	0.258	0.049	0.724
Family size	<4 members	127 (20.0)	55.2±15.6	56.3±16.5	71.7±21.0	61.3±16.7
	>4 members	507 (80.0)	55.7±14.9	57.5±15.8	72.5±21.1	61.2±15.7
	Beta coefficient (Standard Error)		0.1 (0.2)	0.3 (0.3)	-0.3 (0.3)	-0.1 (0.2)
	P value		0.773	0.345	0.429	0.546
Father education	High school or less	562 (88.6)	55.9±15.0	57.4±15.7	72.1±21.2	61.5±15.9
	Above high school	72 (11.4)	52.8±15.3	56.3±17.6	74.2±20.0	58.8±16.5
	Beta coefficient (Standard Error)		0.1 (0.1)	0.1 (0.1)	0.1 (0.1)	-0.1 (0.1)
	P value		0.483	0.119	0.573	0.899
Father Occupation	Not employed	18 (2.8)	53.5±15.7	56.6±18.0	78.7±21.0	59.6±14.2
	Employed	616 (97.2)	55.6±15.0	57.3±15.9	72.1±21.0	61.2±16.0
	Beta coefficient (Standard Error)		0.1 (0.1)	0.1 (0.1)	0.1 (0.1)	-0.1 (0.1)
	P value		0.214	0.681	0.146	0.452
Mothers Education	High school or less	597 (94.2)	55.4±14.7	57.2±16.0	72.4±20.8	61.0±15.8
	Above high school	37 (5.8)	58.9±19.6	58.7±15.0	70.6±25.3	63.8±17.5
	Beta coefficient (Standard Error)		-0.6 (0.4)	0.7 (0.4)	-0.5 (0.5)	-0.6 (0.4)
	P value		0.065	0.078	0.864	0.556
Mothers Occupation	Homemaker	535 (84.4)	54.9±15.1	56.8±16.3	71.6±21.4	60.9±16.0
	Employed	99 (15.6)	59.0±14.5	59.7±13.3	75.9±18.7	63.0±15.6
	Beta coefficient (Standard Error)		-0.3 (0.4)	0.7 (0.5)	-0.1 (0.6)	0.1 (0.5)
	P value		0.182	0.114	0.699	0.231

Univariate linear regression model was applied to obtain relationship between the variables

Table 2: Relationship between lifestyle characteristics of the study participants and Health-Related Quality of Life domain score

Domain	Variables	Category	Frequency	Physical	Beta coefficient (SE); P-value	Psychosocial	Beta coefficient (SE); P-value	Social relationship	Beta coefficient (SE); P-value	Environmental	Beta coefficient (SE); P-value
Dietary behavior	Dietary pattern	Vegetarian	88 (13.9)	57.0±17.5	Reference	55.4±15.7	Reference	72.8±20.3	Reference	62.6±14.8	Reference
		Eggetarian	80 (12.6)	52.8±15.4	-0.2 (0.8); 0.289	56.2±15.5	1.0 (0.8); 0.558	70.9±18.8	0.1 (0.2); 0.879	60.2±15.3	-0.1 (0.8); 0.658
		Non-vegetarian	466 (73.5)	55.8±14.4	-0.1 (0.8); 0.127	57.8±16.0	1.2 (0.9);0.256	72.4±21.6	0.1 (1.2); 0.471	61.1±16.3	-0.5 (0.9); 0.358
	Eats fruits daily	Yes	292 (46.1)	55.8±14.8	Reference	57.8±16.6	Reference	72.9±20.6	Reference	61.2±15.6	Reference
		No	342 (53.9)	55.4±15.3	-0.5 (1.2); 0.299	56.8±15.3	-1.0 (1.3); 0.389	71.8±21.4	-1.1 (1.7); 0.157	61.2±16.2	0.1 (1.3); 0.299
	Eats vegetables daily	Yes	573 (90.4)	55.5±14.7	Reference	57.2±15.8	Reference	71.9±21.1	Reference	61.4±15.8	Reference
		No	61 (9.6)	56.4±17.8	0.9 (2.0); 0.117	57.4±17.3	0.1 (2.1); 0.188	76.3±19.8	4.3 (2.8); 0.284	59.0±16.8	-2.4 (2.1); 0.899
Tobacco History	Ever smoked tobacco	Yes	44 (6.9)	53.5±12.9	Reference	57.0±16.0	Reference	70.1±21.3	Reference	60.8±16.3	Reference
		No	590 (93.1)	55.7±15.2	2.2 (2.4); 0.589	60.4±14.4	-3.4 (2.5); 0.569	72.5±21.0	2.4 (3.3); 0.477	61.2±15.9	0.4 (2.5); 0.284
	Ever chewed tobacco	Yes	14 (2.2)	55.5±15.1	Reference	63.6±15.2	Reference	71.9±18.1	Reference	64.1±14.6	Reference
		No	620 (97.8)	56.4±12.7	3.0 (3.4); 0.146	57.1±16.0	4.4 (3.6); 0.137	72.3±21.0	2.6 (4.7); 0.263	61.1±15.9	6.7 (3.6); 0.069
	Parents use any form of tobacco	Yes	308 (48.6)	55.5±14.7	Reference	56.1±16.5	Reference	72.6±21.0	Reference	61.6±15.5	Reference
		No	326 (51.4)	55.7±15.4	0.2 (1.2); 0.412	58.5±15.2	-2.4 (1.3); 0.071	72.0±21.1	-0.6 (1.7); 0.161	60.8±16.3	-0.9 (1.3); 0.237
Alcohol History	Ever tried alcohol	Yes	37 (5.8)	57.8±12.0	Reference	63.1±16.7	Reference	79.2±19.3	Reference	61.8±15.1	Reference
		No	597 (94.2)	55.4±15.2	-2.4 (2.5); 0.211	56.9±15.8	-6.2 (2.7); 0.097	71.9±21.1	-7.4 (3.6); 0.043	61.2±16.0	-0.7 (2.7); 0.538
	Parents consume alcohol	Yes	264 (41.6)	54.4±14.8	Reference	57.0±15.2	Reference	71.6±21.3	Reference	60.0±15.4	Reference
		No	370 (58.4)	56.4±15.1	1.9 (1.2); 0.058	57.4±16.4	0.4 (1.3); 0.433	72.8±20.9	1.2 (1.7); 0.111	62.0±16.3	2.0 (1.3); 0.249
Physical Activity	PAL score	<3	562 (88.6)	56.2±14.8	Reference	58.1±15.6	Reference	73.3±21.1	Reference	61.5±16.5	Reference
		>3	72 (11.4)	55.0±14.4	0.4 (0.9); 0.226	55.5±16.3	0.1 (0.9); 0.531	67.0±21.9	-1.7 (1.3); 0.879	60.5±15.9	-0.1 (0.9); 0.433

Note: Header "Transformed domain scores (Mean±SD)" spans the domain score columns.

Continued Table 2: Relationship between lifestyle characteristics of the study participants and Health-Related Quality of Life domain score

Domain	Variables	Category	Frequency	Transformed domain scores (Mean±SD)							
				Physical	Beta coefficient (SE); P-value	Psychosocial	Beta coefficient (SE); P-value	Social relationship	Beta coefficient (SE); P-value	Environmental	Beta coefficient (SE); P-value
Physical Fitness	Harvard Step test	Excellent	79 (12.5)	53.3±15.2	Reference	55.7±14.7	Reference	70.5±21.2	Reference	61.0±16.2	Reference
		Good	90 (14.2)	55.5±14.1	0.9 (1.0); 0.688	56.9±17.3	0.6 (1.8); 0.418	72.7±21.4	0.3 (0.1); 0.114	62.1±18.6	0.5 (0.1); 0.785
		Average	73 (11.5)	55.9±14.7	0.9 (0.9); 0.233	55.5±15.1	0.5 (0.9); 0.512	70.8±21.3	0.1 (0.2); 0.222	59.0±15.6	0.8 (0.6); 0.548
		Low average	67 (10.6)	56.1±15.6	0.4 (0.8); 0.256	59.3±17.5	0.9 (1.0); 0.128	71.4±20.9	0.6 (0.9); 0.157	62.5±14.1	0.5 (0.4); 0.455
		Poor	325 (51.3)	56.0±15.2	0.5 (0.4); 0.115	57.7±15.7	0.5 (0.4); 0.169	73.1±21.0	0.5 (0.6); 0.333	61.2±15.5	0.1 (0.4); 0.232
	Dominant hand grip test	Weak	200 (31.6)	55.8±15.1	Reference	56.5±16.3	Reference	71.5±20.6	Reference	60.7±15.7	Reference
		Normal	214 (33.7)	55.2±15.2	0.1 (0.4); 0.267	58.3±15.6	0.1 (0.5); 0.631	73.0±21.3	0.4 (0.7); 0.972	61.5±16.5	0.5 (0.8); 0.111
		Strong	220 (34.7)	55.7±14.9	-0.1 (0.7); 0.359	56.9±15.9	0.2 (0.8); 0.543	72.3±21.3	0.4 (1.0); 0.864	61.4±15.7	0.4 (0.8); 0.121
	Non-dominant hand grip test	Weak	236 (37.2)	55.4±15.3	Reference	56.3±16.1	Reference	71.6±20.7	Reference	60.5±15.8	Reference
		Normal	192 (30.3)	55.6±14.4	0.1 (0.9); 0.155	58.6±15.3	0.4 (0.7); 0.241	72.8±21.0	0.4 (0.8); 0.243	61.9±16.3	0.8 (0.8); 0.184
		Strong	206 (32.5)	55.7±15.4	0.1 (0.7); 0.176	57.0±16.2	0.4 (0.8); 0.277	72.6±21.5	0.5 (1.0); 0.138	61.3±15.8	0.4 (0.8); 0.222
	Dominant back stretch test	Yes	593 (93.5)	55.8±15.1	Reference	57.5±15.8	Reference	72.7±21.1	Reference	61.3±15.9	Reference
		No	41 (6.5)	52.5±14.0	-3.3 (2.4); 0.481	53.4±17.8	-4.1 (2.6); 0.052	66.5±20.2	-6.2 (3.4); 0.055	59.6±16.4	-1.7 (2.6); 0.191
	Non-dominant back stretch test	Yes	469 (74.0)	56.6±14.9	Reference	58.3±15.9	Reference	73.4±21.3	Reference	62.1±15.8	Reference
		No	165 (26.0)	52.5±14.9	-4.1 (1.4); 0.066	54.1±15.4	-4.3 (1.4); 0.061	69.1±20.1	-4.3 (1.9); 0.035	58.7±16.0	-3.3 (1.4); 0.077

Univariate linear regression model was applied to obtain relationship between the variables

Table 3: Relationship between emotional characteristics of the study participants and Health-Related Quality of Life domain score

Domain	Variables	Category	Frequency	Transformed domain scores (Mean±SD)			
				Physical	Psychosocial	Social relationship	Environ-mental
Emotion and friendship (in last 30 days)	Ever felt lonely	Yes	359 (46.6)	55.6±14.7	57.3±15.8	72.0±21.0	61.0±16.2
		No	275 (43.4)	55.5±15.5	57.2±16.1	72.7±21.1	61.4±15.6
	Beta coefficient (Standard Error)			-0.2 (1.2)	-0.1 (1.2)	0.7 (1.7)	0.4 (1.3)
	P value			0.154	0.149	0.561	0.200
	Could not sleep due to the worry	Yes	352 (55.5)	56.1±14.9	58.1±15.6	72.6±20.6	61.5±15.6
		No	282 (44.5)	54.9±15.2	56.2±16.3	71.9±21.6	60.8±16.3
	Beta coefficient (Standard Error)			-1.2 (1.2)	-1.9 (1.3)	-0.7 (1.7)	-0.7 (1.3)
	P value			0.746	0.590	0.300	0.247
	Have close friends	Yes	591 (93.2)	54.9±15.2	56.6±16.4	72.1±21.1	60.8±16.2
		No	43 (6.8)	57.1±14.7	58.9±14.6	72.9±21.0	60.5±16.4
	Beta coefficient (Standard Error)			2.2 (1.3)	2.3 (1.4)	0.9 (1.8)	1.3 (1.4)
	P value			0.060	0.054	0.125	0.238
	Find hard to stay focused on homework	Yes	378 (59.6)	55.1±14.7	57.7±16.2	72.0±21.1	62.3±15.9
		No	256 (40.4)	56.3±15.5	56.6±15.4	72.7±21.1	59.5±15.9
	Beta coefficient (Standard Error)			1.2 (1.2)	-1.2 (1.3)	0.7 (1.7)	-2.8 (1.3)
	P value			0.589	0.325	0.489	0.036
	Had a hard time answering questions in school	Yes	305 (48.1)	55.3±14.2	58.4±15.3	72.8±20.8	62.4±15.3
		No	329 (51.9)	55.8±15.8	57.3±16.3	71.9±21.3	60.1±16.5
	Beta coefficient (Standard Error)			0.5 (1.2)	-2.2 (1.3)	-0.9 (1.7)	-2.3 (1.3)
	P value			0.399	0.025	0.569	0.063
	Ever felt disturbed after hearing comments from others	Yes	265 (41.8)	56.1±15.1	57.1±15.3	72.8±20.8	62.2±15.3
		No	369 (58.2)	55.1±15.0	57.4±16.3	72.0±21.2	60.5±16.4
	Beta coefficient (Standard Error)			-1.0 (1.2)	0.3 (1.3)	-0.8 (1.7)	-1.7 (1.3)
	P value			0.265	0.896	0.248	0.489
Experience regarding school and home	Ever missed class in the last 30 days	Yes	213 (33.6)	55.6±15.5	57.2±15.2	71.5±20.7	60.5±15.3
		No	421 (66.4)	55.6±14.8	57.2±16.3	72.7±21.2	61.5±16.2
	Beta coefficient (Standard Error)			0.1 (1.3)	0.1 (1.3)	1.2 (1.8)	1.1 (1.3)
	P value			0.364	0.257	0.149	0.257
	Had parents checked their homework in the last 30 days	Yes	552 (87.1)	55.6±15.0	57.4±15.9	72.2±21.2	60.8±16.1
		No	82 (12.9)	55.6±15.3	56.5±15.8	73.1±20.2	63.2±15.0
	Beta coefficient (Standard Error)			0.1 (1.8)	-0.9 (1.9)	1.0 (2.5)	2.9 (1.9)
	P value			0.246	0.357	0.489	0.248
	Do parents understand their worries	Yes	578 (91.2)	55.6±15.1	57.4±15.9	72.2±21.0	61.2±16.0
		No	56 (8.8)	54.8±14.8	55.4±16.1	73.5±21.6	61.4±15.4
	Beta coefficient (Standard Error)			-0.8 (2.1)	-2.0 (2.2)	1.3 (2.9)	0.2 (2.2)
	P value			0.125	0.188	0.233	0.487

Univariate linear regression model was applied to obtain relationship between the variables.

Table 4: Multiple linear regression to determine the factors affecting Health-Related Quality of Life domain scores

Variable	Unit of Measurement	Beta coefficient	Standard Error	P value
Physical				
Age (in years)	10-12=0	Reference		
	13-15=1	0.6	0.4	0.121
	16-19=2	0.7	0.4	0.119
Mothers Education	High school or less=0	Reference		
	Above high school=1	-0.4	0.4	0.285
Parents consume alcohol	Yes=0	Reference		
	No=1	1.7	1.2	0.148
Have close friends	Yes=0	Reference		
	No=1	2.0	1.3	0.127
Non-dominant back stretch test	Yes=0	Reference		
	No=1	-4.1	1.4	0.002
Psychosocial				
Age (in years)	10-12=0	Reference		
	13-15=1	1.2	0.7	0.006
	16-19=2	1.3	0.5	0.004
Mothers Education	High school or less=0	Reference		
	Above high school=1	-0.4	0.4	0.385
Parents using any form of tobacco	Yes=0	Reference		
	No=1	2.3	1.3	0.050
Ever tried alcohol	Yes=0	Reference		
	No=1	-6.3	2.7	0.019
Have close friends	Yes=0	Reference		
	No=1	2.0	1.4	0.137
Had a hard time answering questions in school	Yes=0	Reference		
	No=1	-1.3	1.3	0.309
Dominant back stretch test	Yes=0	Reference		
	No=1	-2.3	2.7	0.397
Non-dominant back stretch test	Yes=0	Reference		
	No=1	-3.9	1.5	0.010
Social relationship				
Type of family	Nuclear=0	Reference		
	Joint=1	-3.0	1.8	0.105
Ever tried alcohol	Yes=0	Reference		
	No=1	-7.7	3.5	0.030
Dominant back stretch test	Yes=0	Reference		
	No=1	-4.6	3.6	0.209
Non-dominant back stretch test	Yes=0	Reference		
	No=1	-3.4	2.0	0.092
Environment				
Age (in years)	10-12=0	Reference		
	13-15=1	0.8	0.6	0.093
	16-19=2	1.5	0.5	0.001
Ever chewed tobacco	Yes=0	Reference		
	No=1	6.5	3.5	0.066
Find hard to stay focus on homework	Yes=0	Reference		
	No=1	-2.4	1.4	0.073
Had a hard time answering questions in school	Yes=0	Reference		
	No=1	-1.1	1.3	0.420
Non-dominant back stretch test	Yes=0	Reference		
	No=1	-3.5	1.4	0.014

Among the lifestyle characteristics of the study participants, the univariate linear regression model found that ever-chewing tobacco was a significant variable (Beta coefficient; SE) for environmental (6.7; 3.6) (P=0.069) domain score; parents using any form of tobacco was found to be a significant variable for psychosocial (-2.4; 1.3) (P=0.071) domain score. Trying alcohol was a significant variable for both psychosocial (-6.2; 2.7) (P=0.097) and social relationship (-7.4; 3.6) (P=0.043) domain scores, while parents not consuming alcohol was a significant variable for physical (1.9; 1.2) (P=0.058) domain score. The negative dominant back stretch test was significantly associated with psychosocial (-4.1; 2.6) (P=0.052) and social relationship (-6.2; 3.4) (P=0.055) domain scores, whereas the non-dominant back stretch test was significantly associated with all the domain scores (P<0.1) (Table 2).

Among the emotional characteristics of the students, univariate linear regression showed that students having close friends were associated with physical and psychological domain scores with a Beta coefficient or SE of 2.2; 1.3 (P=0.060) and 2.3; 1.4 (P=0.054), respectively. Students finding it hard to stay focussed on homework was associated with an environmental domain score with a Beta coefficient or SE of -2.8; 1.3 (P=0.036). Students having a hard time answering questions in school was associated with both psychosocial and environmental domain scores with a Beta coefficient or SE of -2.2; 1.3 (P=0.025) and -2.3; 1.3 (P=0.063), respectively (Table 3).

All the significant variables in the univariate linear regression were considered for multiple linear regression. It was observed that the non-dominant back stretch test was associated (Beta coefficient; SE, P-value) negatively with physical (-4.1; 1.4, 0.002), psychosocial (-3.9; 1.5, 0.010), and environmental (-3.5; 1.4, 0.014) domain scores. These domain scores decreased significantly among students failing the non-dominant back stretch test. The students' age the was significantly

associated (Beta coefficient; SE, P-value) with both psychosocial (1.3; 0.5, 0.004) and environmental (1.5; 0.5, 0.001) domain scores. The scores improved significantly with increasing age. The psychosocial domain score was also associated (Beta coefficient; SE, P value) with parents using any form of tobacco (2.3; 1.3, 0.050) and with students who had ever tried alcohol (-6.3; 2.7, 0.019). The social relationship domain score was significantly associated (Beta coefficient; SE, P-value) with students who had ever tried alcohol (-7.7; 3.5, 0.030) (Table 4).

The correlation matrix among the variables included in multiple linear regression for each domain score revealed that most variables were very weakly correlated. A weak correlation was observed between the dominant back stretch test and non-dominant back stretch test for both psychosocial and social relationship domain scores with a correlation coefficient of 0.37. Similarly, for environmental domain scores, having a hard time answering questions in school and staying focused on homework were weakly correlated with a correlation coefficient of 0.30 (Figure 1).

DISCUSSION

The study measured the HRQoL scores and its determinants using the WHOQOLBREF questionnaire among school-going adolescents in the Garhwal division of Uttarakhand, India with an almost equal proportion of boys and girls participating in the study, mostly in the age group of 13-16 years. The present study is the second of its kind among normal adolescents in an Indian setting and the first one in Uttarakhand, India. It covered various districts in different altitude zones of the Garhwal division of Uttarakhand. It will serve as a baseline for any further assessment of HRQoL among adolescents.

The HRQoL of the study participants was average as most of them scored around half the total score in all domains except for the social relationship domain, which was 72.3.
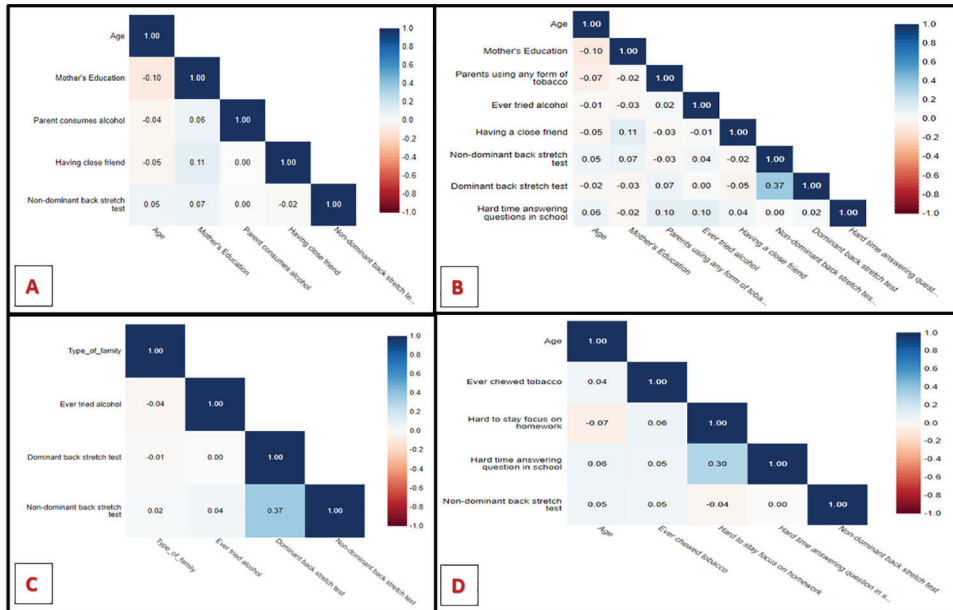
Figure 1: Correlation matrix among variables included in multivariable linear regression model for each of the domain scores. A) Physical domain B) Psychosocial domain C) Social Relationship domain D) Environment domain

The worst score was for the physical domain, with a mean of 55.6. This is similar to the study conducted among healthy adolescents in Chennai, India.[27] The study reported physical domain raw scores as 23.57 (i.e., transformed score of around 56), psychological domain raw score of 21.24 (i.e., transformed score of around 63), social relationship domain raw score of 11.22 (i.e., transformed score of around 69), and environmental domain raw score of 28.14 (i.e., transformed score of around 63). It is necessary to transform the raw scores as the number of items in each domain is different and, hence, not comparable. Even though the results of the present study are similar to this study, there are methodological differences. The present study was conducted among students across various districts of Uttarakhand. In contrast, the study in Chennai was conducted in two schools and one engineering college, with the majority of students being above 15 years. A study conducted in Malaysia among adolescents also reported that the social relationship domain scored a maximum.[28] Even though the study used different tools, the results were consistent. The probable reason for a high score in the social relationship is good peer and family support. A study

conducted among adolescents in Haryana, India reported that both victimized and non-victimized adolescents received good family support. The family support was maximum for previously victimized ones.[29] They also reported that family and peer support among adolescents increased social behavior among them. Another study conducted in Finland also reported good social support among adolescents in general.[30]

The present study showed that the age of the adolescent was positively associated with psychological domain score. The psychological domain includes items that enquire about happiness in life, feelings of success in life, satisfaction in life etc.; hence, the response to these items improves with age due to a better understanding of life in general. A study where a 10-year experience sampling was done reported that aging was associated with more emotional stability and well-being.[31] Another study also reported that a sense of purpose among individuals helped them perform better while aging.[32] Even though these studies were conducted among individuals above 18 years of age, they emphasize the fact that it is important to boost the psychological domain of the adolescents transitioning to adulthood. In the present

study, age was also positively associated with the environmental domain score. This domain includes factors like financial resources, freedom, physical safety and security, home environment, opportunities for acquiring new information and skills, participation in and opportunities for recreation/ leisure activities, etc.[26] With the increase in age, all these factors are expected to increase; hence, there was an increase in domain scores.

The present study showed that parents consuming any form of tobacco was inversely associated with the psychological domain score. This is similar to a study conducted in Taiwan which reported that parents' smoking negatively affected adolescent health-promoting behaviors.[33] Parental smoking increases the chance of adolescent smoking in the family. Adolescent smoking is associated with emotional/behavioral problems in adolescents;[34] hence, a decrease in psychosocial domain score is expected. This highlights the lack of knowledge and awareness about the ill effects of tobacco among the students and necessitates the importance of health promotional activities in school.

In the present study, the student who had ever tried alcohol was positively associated with both psychosocial and social relationship domain scores. The score improved among students who had tried alcohol. A study reported that both emotional and social functioning are affected among adolescents consuming alcohol.[35] Alcohol consumption among adolescents is inversely associated with family support and school satisfaction.[36] The findings in the present study are not consistent with the above studies. The difference in the findings may be explained by a smaller proportion of students (5.8%) who had consumed alcohol. The above-mentioned studies included adolescents consuming alcohol regularly. A study conducted among the Norwegian population reported that adolescent alcohol consumption was associated with improved friendship quantity and quality.[37] They also reported that light drinkers were emotionally happier. These findings were similar to our study. There is a difference in the culture and background of the study participants compared with the present study; hence, the results should be compared cautiously.

The present study showed that the non-dominant hand back stretch test was associated with physical, psychosocial, and environmental domain scores. The score decreases with the inability to perform back-stretch test with a non-dominant hand. A similar finding was reported by a study conducted among adolescents aged 12-18 years of age.[38] The study reported that HRQoL score improved with muscular fitness. The ability to perform a back-stretch test indicates good muscular fitness. This improves the physical and emotional well-being of an adolescent. Participation in physical fitness during childhood and adolescence improves self-efficacy, quality of life, and social factors of an individual and is a modifiable determinant.[39]

The strength of our study was that it was among the first attempts in the state of Uttarakhand at assessing the Health-related Quality of Life among normal adolescents using a validated WHOQOLBREF tool adapted to the cultural setting. It was a school-based study with a representative sample across different altitude zones in Garhwal region. It was also a comprehensive study covering various domains affecting quality of life. All the tools used were validated for use in Indian settings. The limitation of our study is that it can only be generalized to similar settings and only among school-going students not suffering from any disease affecting their physical activity.

Conclusion

The study concluded that all domains of HRQoL needed to be improved to address the much-neglected psychological, social, and mental well-being of the school-going adolescents. Positive association of age with

psychosocial and environmental domain scores in the present study indicates the need for taking care of younger adolescents more than older ones. Promotion of healthy behavior among parents regarding abstinence from tobacco consumption is imperative for better psychosocial well-being of adolescents and should be undertaken regularly by school authorities if possible. Although alcohol consumption among adolescents themselves was found to be positively associated with psychosocial and social domain scores in the present study, it needs further exploration and should not be promoted. Physical activity and fitness were identified as important modifiable predictors of HRQoL and should be promoted regularly in schools for the holistic development of adolescents, along with traditional subjects.

ACKNOWLEDGEMENT

Conflict of Interest: None declared.

REFERENCES

1   National Academies of Sciences, Engineering, and Medicine, Health and Medicine Division, Division of Behavioral and Social Sciences and Education, et al. The Promise of Adolescence: Realizing Opportunity for All Youth. US: National Academies Press; 2019.

2   United Nations International Children's Emergency Fund. Adolescent Data Portal. US: United Nations International Children's Emergency Fund; 2023. [Cited 2 May 2023]. Available from: https://data.unicef.org/adp/country-details/

3   World Health Organization. Basic Documents. 49th ed. Geneva: World Health Organization; 2020.

4   Browne JP, O'Boyle CA, McGee HM, et al. Individual quality of life in the healthy elderly. Quality of Life Research. 1994;3:235-44.

5   Martinez-Martin P, Prieto-Flores ME, Forjaz MJ, et al. Components and determinants of quality of life in community-dwelling older adults. European Journal of Ageing. 2012;9:255-63.

6   Cieza A, Stucki G. Content comparison of health-related quality of life (HRQOL) instruments based on the international classification of functioning, disability and health (ICF). Quality of Life Research. 2005;14:1225-37.

7   Varni JW, Seid M, Knight TS, et al. The PedsQL 4.0 Generic Core Scales: sensitivity, responsiveness, and impact on clinical decision-making. Journal of Behavioral Medicine. 2002;25:175-93.

8   Davis SE, Hynan LS, Limbers CA, et al. The PedsQL in pediatric patients with Duchenne muscular dystrophy: feasibility, reliability, and validity of the Pediatric Quality of Life Inventory Neuromuscular Module and Generic Core Scales. Journal of Clinical Neuromuscular Disease. 2010;11:97-109.

9   Sodergren SC, Husson O, Robinson J, et al. Systematic review of the health-related quality of life issues facing adolescents and young adults with cancer. Quality of Life Research. 2017;26:1659-72.

10 Awasthi S, Agnihotri K, Chandra H, et al. Assessment of Health-Related Quality of Life in school-going adolescents: validation of PedsQL instrument and comparison with WHOQOL-BREF. National Medical Journal of India. 2012;25:74-9.

11 Kumari R, Nath B, Singh Y, Mallick R. Health-related physical fitness, physical activity and its correlates among school going adolescents in hilly state in north India: a cross sectional survey. BMC Public Health. 2024;24:401.

12 World Health Organization. Global school-based student health survey, 2021. Geneva: World Health Organization; 2021.

13 Kowalski KC, Crocker PRE, Kowalski NP. Convergent Validity of the Physical Activity Questionnaire for Adolescents. Pediatric Exercise Science. 1997;9:342-52.

14 Janz KF, Lutuchy EM, Wenthe P, Levy SM. Measuring activity in children and adolescents using self-report: PAQ-C and PAQ-A. Medicine and Science in Sports and Exercise. 2008;40:767-72.

15 Aggio D, Fairclough S, Knowles Z, Graves L. Validity and reliability of a modified English version of the physical activity questionnaire for adolescents. Archives of Public Health. 2016;74:3.

16 Dave H, Nimbalkar SM, Vasa R, Phatak AG. Assessment of Physical Activity among Adolescents: A Cross-sectional Study. Journal of Clinical and Diagnostic Research. 2017;11:SC21-4.

17 Sigmundová D, El Ansari W, Sigmund E, Frömel K. Secular trends: a ten-year comparison of the amount and type of physical activity and inactivity of random samples of adolescents in the Czech Republic. BMC Public Health. 2011;11:731.

18 Chiba Y. A Simple Method of Measuring Vaccine Effects on Infectiousness and Contagion. Open Journal of Statistics. 2013;3:7-15.

19 Buono MJ, Roby JJ, Micale FG, et al. Validity and Reliability of Predicting Maximum Oxygen Uptake via Field Tests in Children and Adolescents. Pediatric Exercise Science. 1991;3:250.

20 Mackenzie B. Sit and Reach Test. UK: BrianMac Sports Coach; 2000. [Cited 18 March 2024]. Available from: https://www.brianmac.co.uk/sitreach.htm

21 Wood R. Handgrip Strength Norms. Indonesia: Topend Sports Network; 2012. [Cited 18 March 2024]. Available from: https://www.topendsports.com/testing/norms/handgrip.htm

22 Huang L, Liu Y, Lin T, et al. Reliability and validity of two hand dynamometers when used by community-dwelling adults aged over 50 years. BMC Geriatrics. 2022;22:580.

23 Burnstein BD, Steele RJ, Shrier I. Reliability of fitness tests using methods and time periods common in sport and occupational management. Journal of Athletic Training. 2011;46:505-13.

24 Agnihotri K, Awasthi S, Chandra H, et al. Validation of WHO QOL-BREF instrument in Indian adolescents. Indian Journal of Pediatrics. 2010;77:381-6.

25 Singh K, Junnarkar M. Validation and effect of demographic variables on perceived quality of life by adolescents. Asian Journal of Psychiatry. 2014;12:88-94.

26 World Health Organization. Programme on mental health, WHOQOL user manual, 2012 revision. Geneva: World Health Organization; 1998.

27 Kamaraj D, Sivaprakasam E, Ravichandran L, Pasupathy U. Perception of health related quality of life in healthy Indian adolescents. International Journal of Contemporary Pediatrics. 2016;3:692-9.

28 KA M, Cheah W. Health-Related Quality of Life in Adolescents Attending Secondary School and Its Associated Factors: A Cross-Sectional Study in Kuching and Samarahan Districts in Sarawak, Malaysia. Journal of Indian Association for Child and Adolescent Mental Health. 2020;16:32-56.

29 Chopra R, Punia S, Sangwan S. Effect of Social – Support on Peer-relationship among Adolescents in Haryana. Asian Journal of Agricultural Extension, Economics & Sociology. 2017;19:1-7.

30 Anttila KI, Anttila MJ, Kurki MH, Välimäki MA. Social relationships among adolescents as described in an electronic diary: a mixed methods study. Patient Preference and Adherence. 2017;11:343-52.

31 Carstensen LL, Turan B, Scheibe S, et al. Emotional Experience Improves With Age: Evidence Based on Over 10 Years

of Experience Sampling. Psychology and Aging. 2011;26:21-33.

32 Windsor TD, Curtis RG, Luszcz MA. Sense of purpose as a psychological resource for aging well. Developmental Psychology. 2015;51:975-86.

33 Chen MY. The Negative Impact of Parental Smoking on Adolescents' Health-Promoting Behaviors: A Cross-Sectional Study. International Journal of Environmental Research and Public Health. 2021;18:2514.

34 Giannakopoulos G, Tzavara C, Dimitrakaki C, et al. Emotional, behavioural problems and cigarette smoking in adolescence: findings of a Greek cross-sectional study. BMC Public Health. 2010;10:57.

35 Chen CY, Storr CL. Alcohol Use and Health-Related Quality of Life among Youth in Taiwan. Journal of Adolescent Health. 2006;39:752.

36 Pedroni C, Dujeu M, Lebacq T, et al. Alcohol consumption in early adolescence: Associations with sociodemographic and psychosocial factors according to gender. PLoS One. 2021;16:e0245597.

37 Hoel S, Eriksen BM, Breidablik HJ, Meland E. Adolescent alcohol use, psychological health, and social integration. Scandinavian Journal of Public Health. 2004;32:361-7.

38 Evaristo S, Moreira C, Lopes L, et al. Muscular fitness and cardiorespiratory fitness are associated with health-related quality of life: Results from labmed physical activity study. Journal of Exercise Science and Fitness. 2019;17:55-61.

39 Rutten GM, Savelberg HH, Biddle SJH, Kremers SPJ. Interrupting long periods of sitting: good STUFF. The International Journal of Behavioral Nutrition and Physical Activity. 2013;10:1.