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Morningness-Eveningness and Health-Related Quality of Life among Adolescents

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Accumulating evidence suggests that evening-type adolescents are exposed to a number of determinants that might have a negative impact on their health condition. Given that few studies have investigated the association between chronotype and quality of life measures in large samples of adolescents, the aim of this study was to assess the relationship between morningness-eveningness and health-related quality of life among 1600 adolescents (aged 12-16 years). Adolescents completed the *Veçú et Santé Perçue de L´adolescent* (*VSP-A*) and the *Morningness-Eveningness Scale for Children* (*MESC*). Girls and older adolescents reported worse health indicators and were more evening oriented. Evening-type adolescents obtained lower scores on vitality, physical and psychological well-being, body image, relations with parents, relations with teachers, school work and global health scale.
Keywords: adolescents, morningness-eveningness, health-related quality of life, chronotype.

La evidencia acumulada sugiere que los adolescentes vespertinos están expuestos a cierto número de determinantes que podrían tener un impacto negativo en su estado de salud. Dado que pocos estudios han investigado la asociación entre cronotipo y medidas de calidad de vida en una amplia muestra de adolescentes, el objetivo de este estudio fue evaluar la relación entre matutinidad-vespertinidad y calidad de vida relacionada con la salud en 1600 adolescentes (12-16 años). Los adolescentes completaron el *Cuestionario de Salud Percibida y Vivida del Adolescente* (*VSP-A*) y la *Escala de Matutinidad-Vespertinidad para Niños* (*MESC*). Las chicas y los adolescentes mayores informaron de peores indicadores de salud y tuvieron mayor tendencia a la vespertinidad. Los adolescentes vespertinos obtuvieron puntuaciones más bajas en vitalidad, bienestar físico y psicológico, autoestima, relaciones con padres, relaciones con profesores, actividades escolares y puntuación global de salud.
Palabras clave: adolescentes, matutinidad-vespertinidad, calidad de vida relacionada con la salud, cronotipo.

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The notion of Health-Related Quality of Life (HRQL) is derived from the concept of Quality of Life as defined by the World Health Organization in 1966 (http://www.who.int). It refers to people's subjective evaluations of the influences of their current health-status, health care and health promoting activities on their ability to achieve and maintain a level of overall functioning that allows them to pursue valued life goals, and that is reflected in their general well-being (Shumaker & Naughton, 1995). HRQL has achieved notoriety in both adult and adolescent population (Carr, Higginson, & Robinson, 2003). This increasing interest has been reflected in a gradual growing of papers about that issue since a decade (Rajmil, Estrada, Herdman, Serra-Sutton, & Alonso, 2001).

In comparison to disease-specific instruments, generic scales are designed for a global use (regardless the specific health problem) and are usually applied to populations characterized by an absence of pathology. Thus, they are really useful in public health investigations whose aim is to describe population health and/or to compare between subgroups with demographic and lifestyle characteristics (Rajmil et al., 2001). The objective of generic scales is to detect possible health needs as well as inequalities or health problems masked or unexpected (Solans et al., 2008).

In recent years, an increase in the development of generic instruments that assess HRQL on children and adolescents has been verified inside and outside Spain. Specifically, the most recent revision includes almost 30 instruments (Solans et al., 2008), whereas Pane et al. (2006) indicate that, from 1996 to 2001, three of these instruments have been constructed per year and eight scales are available in Spanish.

Several studies conducted in Spain and other European countries with adolescent samples showed that girls report poorer self-rated health than boys and that older adolescents (15 years or older) report poorer self-rated health than younger (11 to 13 years) adolescents (Bisseger, Cloetta, Von Bisseger, Abel, & Ravens-Sieberer, 2005; Levin, Currie, & Muldoon, 2009; Michel, Bisegger, Fuhr, & Abel, 2009; Nuviala, Ruiz, & Nuviala, 2010). Thus, the age of 13 or 14 years seems to be the moment from which adolescents begin to report a poorer HRQL.

Approximately at the same age, a shift from morningness towards eveningness takes place (Díaz-Morales & Gutiérrez, 2008; Kim, Dueker, Hasher, & Goldstein, 2002; Yang, Kim, Patel, & Lee, 2005). Morningness-Eveningness (M/E) reflects individual differences in circadian rhythms of several biological and psychological processes (Leonhard & Randler, 2009). Although these differences in M/E can be measured on a continuous scale (Natale & Cicogna, 2002), often both ends are viewed in a dichotomous manner contrasting morning and evening types, with the latter showing a phase delay in the maximum of some circadian rhythms such as oral temperature (Natale & Alzani, 2001), cortisol and melatonin secretion (Baehr, Revelle, & Eastman, 2000; Kudielka, Federenko, Hellhammer, & Wüst, 2006), heart rate, subjective alertness or memory (Kerkhof, 1985; Reinberg et al., 1988).

Considering the interaction between a person's rhythms and those of the environment (i.e. dark-light cycle, schedules or social cues), morning and evening types show differences in behavioural habits (Nakade, Takeuchi, Kurotani, & Harada, 2009), personality (DeYoung, Hasher, Djikic, Criger, & Peterson, 2007; Díaz-Morales, 2007), patterns of social development (Cofer et al., 1999) and cognitive performance (Goldstein, Hahn, Hasher, Wiprzycka, & Zelazo, 2007). These differences between morning and evening types also appear in several health indicators. Among adolescents, evening preference has been associated with an array of disturbances including emotional problems (Gaina et al., 2006; Giannotti, Cortesi, Sebastiani, & Ottaviano, 2002; Takeuchi, Oishi, & Harada, 2005), eating disorders (Schmidt & Randler, 2010) and behavioural and health risk difficulties (Gau et al., 2007; Lange & Randler, 2011).

Accumulating evidence suggests that evening-type adolescents are exposed to a number of determinants that might have a negative impact on their health condition. Evening types' preference for delayed bedtimes and rise times is often out of sync with sleep-wake schedules required by school, work or social obligations. Several studies have shown that evening types are more likely to have inaccurate sleep beliefs than other circadian types (Adan, Fabbri, Natale, & Pratt, 2006; Díaz-Morales, Delgado, Escribano, Collado, & Randler, in press; Digdon, 2010). Moreover, some research indicated that morning types show a better school performance in comparison to evening types (Beşoluk, 2011; Beşoluk, Önder & Deveci, 2011; Escribano, Díaz-Morales, Delgado & Collado, 2012; Randler & Frech, 2009). Wittmann, Dinich, Merrow, and Roenneberg (2006) proposed the notion of social jetlag to describe the discrepancy between a person's rhythms and those of the environment or, in other words, the misalignment of biological and social (school) time. In order to meet societal demands, evening types must try to function during the morning when they are in their non-optimal moment of the day. Moreover, as indicated above, adolescence is an especially critical phase because changes in M/E occur during the lifespan and these changes are extremely remarkable during adolescence. Children are usually morning-oriented (Werner, LeBurgeois, Geiger, & Jenni, 2009), while adolescents shift towards eveningness (Crowley, Acebo, & Carskadon, 2007; Roenneberg et al., 2004). This change, together with early school start times may be the basis of the beginning of health problems such as substance use (Gau et al., 2007) or depressive tendencies (Kim et al., 2010).

Nevertheless, few studies have investigated the association between chronotype and quality of life measures in large samples of adolescents. Recently, Randler (2011) found links between eveningness and poor physical and mental health, low self-esteem and negative familial relationship and school functioning. Tzischinsky & Shochat (2011) indicated that evening-type adolescents obtained lower scores on physical, emotional, social, school, psychosocial functioning and overall quality of life.

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The aim of this study was to assess the relationship between M/E and HRQL in a large sample of Spanish adolescents from 12 to 16 years. The great size of the sample is convenient given that several authors point out that some differences between groups in M/E only emerge when large samples are used (Natale & Cicogna, 2002; Randler, 2007).

Method

Participants

A group of 1600 adolescents aged between 12 and 16 years (M = 14.13, SD = 1.47) participated in this study. 49.6 % were girls. All the participants were studying Compulsory Secondary Education in 6 public schools selected, by means of a simple random sampling process, from an urban area located in the east of the Autonomous Community of Madrid (Spain). The area where the study took place comprises several cities with a population of over 100,000 people each. The schools participating in the study are located in three of these cities. Approximately the 35% of the active population works in the industrial sector. The socioeconomic status is middle class. Participation was voluntary, unpaid and anonymous.

Instruments

Morningness-Eveningness Scale for Children (MESC). This instrument is an adaptation of the *Composite Scale of Morningness* (Smith, Reilly, & Midkiff, 1989) carried out by Carskadon, Vieira, and Acebo (1993). It is used to assess M/E orientation in adolescents. It is comprised of ten questions written so as to allow children and adolescents to understand the language and it has a response scale with four or five response options. Three items have a response scale of five points (1 to 5) and seven items have a response scale of four points (1 to 4). Score ranges from 10 (eveningness) to 43 (morningness). The Spanish adaptation was published by Díaz-Morales & Gutiérrez (2008) and the internal consistency (α) of the *MESC* was Cronbach's alpha = .82 (Díaz-Morales & Gutiérrez, 2008). In the present study, internal consistency was Cronbach's alpha = .70. The scale has been adapted to different cultural contexts and validity has been contrasted, taking into account sleeping habits, self-assessment of the level of alertness, physical achievement, and mood (Caci, Robert, Dossios, & Boyer, 2005; Díaz-Morales, Dávila, & Gutiérrez, 2007; Gau & Soong, 2003; Kim et al., 2002; Natale & Bruni, 2000).

Veçú et santé perçue de l´adolescent (VSP-A). This instrument is a generic questionnaire developed in France (Simeoni, Auquier, Antoniotti, Sapin, & San Marco, 2000) that assesses HRQL in adolescents. It is comprised of thirty-nine items distributed in eleven dimensions: Vitality, physical well-being, psychological well-being, body image, relations with friends, relations with parents, relations with teachers, school work, leisure, relations with health professionals and sentimental and sexual life (the latter two subscales were not included in the present study). The response scale of this instrument has five options. Higher scores indicate better HRQL. The Spanish adaptation was carried out by Serra-Sutton et al. (2002; 2006) and the internal consistency was satisfactory with alpha coefficients ranging from Cronbach's alpha = .71 (leisure) to Cronbach's alpha = .92 (school work). In the present study, reliability coefficients were adequate (Cronbach´s alpha): Vitality (.85), physical well-being (.69), psychological well-being (.80), body image (.81), relations with friends (.88), relations with parents (.88), relations with teachers (.91), school work (.92), leisure (.71), and global health (.89).

Procedure

Spanish versions of the instruments were used. *MESC* and *VSP-A* were completed during the morning school schedule. A Kolmogorov-Smirnov test was conducted to check the goodness of fit of the frequency distribution of *MESC* scores to the normal curve. Both Multidimensional Analysis of Variance (*MANOVA*) and Analysis of Variance (*ANOVA*) were conducted to examine age and gender effects on HRQL and M/E, respectively. Finally, a Multidimensional Analysis of Covariance (*MANCOVA* age as a covariate) was conducted to analyze chronotype and gender effects on HRQL. The SPSS-X statistical package was used (version 15).

In order to separate evening, neither and morning types, extreme percentiles (10/90 or 20/80) are usually taken (Cofer et al., 1999; Díaz-Morales et al, 2007; Smith et al, 1989). In the present study, percentiles 20/80 were used.

Results

First, preliminary analysis was conducted to examine frequency distribution of *MESC* scores and age (12, 13, 14, 15 and 16 years) and gender (boys and girls) effects on HRQL and M/E.

Frequency distribution of the *MESC* did not show skewness (value = – .00, error = .06) or kurtosis (value = – .18, error = .12) and did not statistically differ from the normal curve (*Kolmogorov-Smirnov´s Z* = 2.15, $p < .001$).

With regard to *VSP-A*, multivariate contrasts indicated significant effects for gender, *Wilks' Lambda* = .77, $F(9, 1582) = 51.91$, $p < .001$, age, *Wilks' Lambda* = .89, $F(9, 1585) = 17.70$, $p < .001$, and gender*age interaction, *Wilks' Lambda* = .95, $F(9, 1585) = 6.80$, $p < .001$.

Boys obtained higher scores in vitality, $F(1, 1590) = 81.61$, $p < .001$, physical well-being, $F(1, 1590) = 139.34$, $p < .001$, psychological well-being, $F(1, 1590) = 144.74$, $p < .01$, body image, $F(1, 1590) = 116.81$, $p < .001$, leisure, $F(1, 1590) = 24.51$, $p < .001$, and global health, $F(1, 1590) = 60.11$, $p < .001$, whereas girls obtained higher scores in relations with

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Table 1
Means and standard deviations of HRQL by gender and age

		12			13			14			15			16			Total		
		M	*SD*	*N*	*M*	*SD*	*N*	*M*	*SD*	*N*	*M*	*SD*	*N*	*M*	*SD*	*N*	*M*	*SD*	*N*
VIT	Girls	64.89	21.25	131	58.11	21.75	148	55.17	21.19	178	51.32	19.46	189	51.45	21.48	148	55.71	21.45	794
	Boys	66.42	21.77	113	65.33	20.59	181	64.68	20.60	201	65.21	18.95	167	66.39	18.83	144	65.48	20.09	806
	Total	65.59	21.46	244	62.08	21.39	329	60.21	21.39	379	57.84	20.41	356	58.82	21.52	292	60.63	21.34	1600
PHY	Girls	68.23	18.99	131	60.35	18.44	148	57.48	18.30	178	54.60	18.39	189	51.56	18.05	148	58.00	19.14	794
	Boys	69.80	16.43	113	71.72	18.29	181	67.63	17.69	201	69.35	18.05	167	68.32	19.47	144	69.33	18.08	806
	Total	68.95	17.83	244	66.60	19.18	329	62.86	18.66	379	61.52	19.64	356	59.82	20.52	292	63.71	19.45	1600
PSY	Girls	67.10	21.91	131	57.23	23.16	148	53.57	22.63	178	49.92	21.43	189	46.59	22.05	148	54.31	23.15	794
	Boys	73.81	21.70	113	74.03	18.37	181	67.56	21.62	201	63.38	20.63	167	61.22	21.69	144	67.89	21.31	806
	Total	70.20	22.03	244	66.47	22.27	329	60.99	23.15	379	56.24	22.08	356	53.80	23.03	292	61.15	23.25	1600
BI	Girls	73.76	25.56	131	65.29	29.95	148	66.08	29.75	178	61.04	29.17	189	57.77	31.32	148	64.45	29.67	794
	Boys	76.66	22.99	113	76.73	24.11	181	80.60	24.49	201	81.06	24.27	167	81.86	21.67	144	79.50	23.71	806
	Total	75.10	24.40	244	71.58	27.45	329	73.78	28.01	379	70.44	28.74	356	69.65	29.52	292	72.03	27.86	1600
FRI	Girls	75.92	21.62	131	76.86	22.03	148	75.87	21.57	178	75.85	24.65	189	74.12	21.70	148	75.73	22.42	794
	Boys	64.07	21.95	113	65.99	20.63	181	67.11	21.97	201	69.13	20.52	167	76.53	18.42	144	68.54	21.11	806
	Total	70.43	22.52	244	70.88	21.92	329	71.23	22.19	379	72.70	23.02	356	75.31	20.15	292	72.11	22.06	1600
PA	Girls	65.94	24.64	131	60.90	27.33	148	58.22	25.53	178	58.10	26.33	189	57.85	25.09	148	59.89	25.94	794
	Boys	61.34	24.06	113	60.36	24.63	181	59.11	24.76	201	57.97	25.10	167	62.24	25.11	144	60.03	24.75	806
	Total	63.81	24.43	244	60.60	25.84	329	58.69	25.10	379	58.04	25.73	356	60.02	25.15	292	59.96	25.34	1600
TEA	Girls	68.58	22.45	131	59.12	25.83	148	55.57	24.08	178	58.02	22.76	189	58.39	22.09	148	59.49	23.81	794
	Boys	59.22	24.76	113	58.75	25.75	181	51.87	27.52	201	52.05	24.43	167	57.52	24.68	144	55.49	25.76	806
	Total	64.24	23.96	244	58.92	25.75	329	53.61	25.99	379	55.22	23.72	356	57.96	23.37	292	57.47	24.89	1600
SCH	Girls	60.40	26.86	131	51.18	25.81	148	48.38	25.80	178	46.23	23.35	189	48.06	22.43	148	50.31	25.21	794
	Boys	62.39	25.25	113	55.25	26.25	181	51.31	27.00	201	47.23	25.98	167	47.66	25.22	144	52.25	26.49	806
	Total	61.32	26.09	244	53.42	26.09	329	49.93	26.45	379	46.70	24.58	356	47.86	23.81	292	51.29	25.87	1600
LE	Girls	63.98	22.14	131	65.29	22.28	148	63.03	22.23	178	62.27	24.10	189	61.36	24.67	148	63.11	23.13	794
	Boys	63.38	21.94	113	68.61	21.20	181	68.38	23.42	201	70.81	19.21	167	72.74	20.85	144	69.01	21.56	806
	Total	63.70	22.00	244	67.12	21.73	329	65.86	22.99	379	66.27	22.32	356	66.97	23.53	292	66.09	22.54	160
GH	Girls	67.64	12.92	131	61.59	12.87	148	59.26	13.88	178	57.48	12.58	189	56.35	12.08	148	60.11	13.41	794
	Boys	66.34	11.86	113	66.31	12.20	181	64.25	12.86	201	64.02	11.38	167	66.05	12.20	144	65.28	12.17	806
	Total	67.04	12.43	244	64.19	12.70	329	61.91	13.56	379	60.55	12.45	356	61.13	13.06	292	62.72	13.05	160

Note: VIT = Vitality; PHY = Physical Well-Being; PSY = Psychological Well-Being; BI = Body Image; FRI = Relations with Friends; PA = Relations with Parents; TEA = Relations with Teachers; SCH = School Work; LE = Leisure; GH = Global Health.

Table 2
Means and standard deviations of HRQL by gender and chronotype controlling for age

		E-types			N-types			M-types			Total		
		M	*SD*	*N*	*M*	*SD*	*N*	*M*	*SD*	*N*	*M*	*SD*	*N*
VIT	Girls	52.31	23.44	175	55.20	20.45	451	60.625	21.19	168	55.71	21.45	794
	Boys	60.90	20.38	167	65.39	19.11	428	69.31	21.09	211	65.48	20.09	806
	Total	56.51	22.39	342	60.16	20.44	879	65.46	21.54	379	60.63	21.34	160
PHY	Girls	53.46	19.77	175	58.62	18.43	451	61.05	19.61	168	58.00	19.14	794
	Boys	63.85	19.50	167	69.66	17.74	428	73.02	16.56	211	69.33	18.08	806
	Total	58.53	20.29	342	63.99	18.91	879	67.71	18.91	379	63.71	19.45	160
PSY	Girls	48.74	22.34	175	54.52	22.35	451	59.55	24.88	168	54.31	23.15	794
	Boys	62.93	23.53	167	68.04	20.67	428	71.52	20.04	211	67.89	21.31	806
	Total	55.67	23.97	342	61.10	22.57	879	66.21	23.06	379	61.15	23.25	160
BI	Girls	60.86	30.38	175	64.05	29.98	451	69.27	27.56	168	64.45	29.67	794
	Boys	79.57	24.17	167	78.33	23.80	428	81.81	23.09	211	79.50	23.71	806
	Total	69.99	29.04	342	71.00	28.06	879	76.25	25.89	379	72.03	27.86	160
FRI	Girls	77.63	22.86	175	74.71	22.36	451	76.49	22.10	168	75.73	22.42	794
	Boys	68.95	22.47	167	68.95	20.06	428	67.37	22.11	211	68.54	21.11	806
	Total	73.39	23.05	342	71.91	21.45	879	71.41	22.54	379	72.11	22.06	160
PA	Girls	55.21	28.02	175	59.59	24.84	451	65.59	25.67	168	59.89	25.94	794
	Boys	52.58	23.09	167	59.51	24.44	428	66.97	24.88	211	60.03	24.75	806
	Total	53.93	25.73	342	59.55	24.63	879	66.36	25.21	379	59.96	25.34	160
TEA	Girls	53.29	24.74	175	59.16	23.04	451	66.82	22.99	168	59.49	23.81	794
	Boys	46.56	25.20	167	55.92	25.77	428	61.69	24.29	211	55.49	25.76	806
	Total	50.00	25.16	342	57.58	24.45	879	63.96	23.83	379	57.47	24.89	160
SCH	Girls	42.21	25.69	175	51.52	24.48	451	55.51	24.80	168	50.31	25.21	794
	Boys	46.48	27.71	167	52.92	25.75	428	55.45	26.39	211	52.25	26.49	806
	Total	44.30	26.74	342	52.20	25.11	879	55.47	25.66	379	51.29	25.87	160
LE	Girls	65.29	23.84	175	62.96	22.46	451	61.27	24.09	168	63.11	23.13	794
	Boys	69.76	23.37	167	69.60	20.14	428	67.24	22.83	211	69.01	21.56	806
	Total	67.47	23.68	342	66.19	21.61	879	64.59	23.55	379	66.09	22.54	1600
GH	Girls	56.56	13.89	175	60.04	12.82	451	64.02	13.46	168	60.11	13.41	794
	Boys	61.29	12.45	167	65.37	11.85	428	68.26	11.76	211	65.28	12.17	806
	Total	58.87	13.40	342	62.63	12.63	879	66.38	12.70	379	62.72	13.05	1600

Note: VIT = Vitality; PHY = Physical Well-Being; PSY = Psychological Well-Being; BI = Body Image; FRI = Relations with Friends; PA = Relations with Parents; TEA = Relations with Teachers; SCH = School Work; LE = Leisure; GH = Global Health; E-types = evening-types; N-types = neither-types; M-types = morning-types.

friends, $F(1, 1590) = 42.54$, $p < .001$, and relations with teachers, $F(1, 1590) = 10.58$, $p = .001$ (see table 1).

Post-hoc comparisons (*Bonferroni test, p < .05*) indicated that 12 and 13 year groups obtained higher scores than 14, 15 and 16 year groups (table 1) on vitality, $F(4, 1590) = 5.64$, $p < .001$, physical well-being, $F(4, 1590) = 10.75$, $p < .001$, psychological well-being, $F(4, 1590) = 27.14$, $p < .001$, relations with teachers, $F(4, 1590) = 7.53$, $p < .001$, school work, $F(4, 1590) = 14.50$, $p < .001$ and global health, $F(4, 1590) = 11.65$, $p < .001$.

Regarding gender*age interaction effect, *post-hoc comparisons* indicated that 12-year-old girls obtained higher scores than 15-and 16-year-old girls on physical well-being and body image, $F(4, 1590) = 6.83$, $p < .001$ and $F(4, 1590) = 6.42$, $p < .001$, respectively. Sixteen-year-old boys scored higher in relations with friends, $F(4, 1590) = 5.02$, $p = .01$, and leisure $F(4, 1590) = 2.98$, $p < .05$ than younger boys (12 to 15 years). Finally, 12- and 13-year-old girls scored higher in vitality and global health than 14-to-16-year-old girls, $F(4, 1590) = 4.80$, $p = .01$ and $F(4, 1590) = 6.72$, $p < .001$, respectively.

Continuing with *MESC*, an *ANOVA* was realized to analyze age (12, 13, 14, 15 and 16 years) and gender effects on *MESC*. The analysis indicated significant effects for gender, $F(1, 1608) = 5.49$, $p < .05$, and age, $F(4, 1608) = 13.17$, $p < .001$. Effect of interaction gender*age was not significant, $F(4, 1608) = 1.47$, $p = .21$.

Boys, $M = 25.32$, $SD = 4.67$, were more morning oriented than girls, $M = 24.81$, $SD = 4.36$. *Post-hoc comparisons* indicated that 12- and 13-year-old adolescents, $M = 26.64$, $SD = 4.55$ and $M = 25.66$, $SD = 4.47$, respectively, scored higher in M/E than 14-year-old, $M = 24.33$, $SD = 4.42$, 15-year-old, $M = 24.61$, $SD = 4.46$, and 16-year-old adolescents, $M = 24.60$, $SD = 4.39$.

In order to analyze at what age gender differences emerged, *Student´s t tests* were conducted for each age group separately considering gender as an independent factor and *MESC* scores as dependent variable. Boys, $M = 26.28$, $SD = 4.46$, claimed a greater morningness tendency than girls, $M = 24.89$, $SD = 4.38$, in the 13 year age group, $t(336) = -2.88$, $p < .01$. There were no age differences in all other age groups: 12 years, $t(243) = 0.28$, $p = .78$, 14 years, $t(383) = -0.44$, $p = .66$, 15 years, $t(356) = -0.63$, $p = .53$, and 16 years, $t(290) = -1.76$, $p = .08$.

We realized a *MANCOVA* to check chronotype (morning, neither and evening-types) and gender effects on *VSP-A*. Because of the existence of age differences in both *VSP-A* and *MESC*, age was included as a covariate. Percentiles 20/80 (21 and 29 scores of *MESC*) were used to separate evening, neither and morning types. Multivariate contrasts indicated significant effects for gender, *Wilks' Lambda* = .79, $F(9, 1585) = 47.73$, $p < .001$, and chronotype, *Wilks' Lambda* = .92, $F(9, 1586) = 13.56$, $p < .001$. Effect of interaction gender*chronotype was no significant, *Wilks' Lambda* = .99, $F(9, 1586) = 0.92$, $p = .51$.

As mentioned in preliminary analysis, boys scored higher than girls on vitality, physical well-being, psychological well-being, body image, leisure and global health scale. Girls obtained higher scores in relations with friends and relations with teachers.

Post-hoc comparisons indicated that morning-type adolescents obtained higher scores than evening-type adolescents on vitality, $F(2, 1593) = 12.72$, $p < .001$, physical well-being, $F(2, 1593) = 15.92$, $p < .001$, psychological well-being, $F(2, 1593) = 12.56$, $p < .001$, body image, $F(2, 1593) = 3.83$, $p < .05$, relations with parents, $F(2, 1593) = 21.00$, $p < .001$, relations with teachers, $F(2, 1593) = 28.66$, $p < .001$, school work, $F(2, 1593) = 15.18$, $p < .001$ and global health, $F(2, 1593) = 25.32$, $p < .001$.

Neither-type adolescents appeared in an intermediate position in vitality, relations with parents, relations with friends and global health. In all other variables (except body image), neither-type scores were not statistically different from those obtained by morning-types (table 2).

Discussion

The aim of the present study was to examine HRQL of morning and evening-type adolescents. A very large sample of adolescents between 12 and 16 years was used. Evening types reported worse HRQL than morning types. Before interpreting this conclusion, results concerning differences on M/E and HRQL according to age and gender will be discussed.

Focusing on the *VSP-A* subscales, boys obtained higher scores in vitality, physical well-being, psychological well-being, body image, leisure and global health, whereas girls obtained higher scores in relations with friends and relations with teachers. The data were similar to those reported in Spanish and French studies (Serra-Sutton et al., 2009; Simeoni et al., 2000; Simeoni, Sapin, Antoniotti, & Auquier, 2001). Girls scored lower on HRQL, which is in line with previous research (Bisseger et al., 2005; Levin et al., 2009; Nuviala et al., 2010).

The attempts to explain these gender differences have been scarce. Sweeting (1995) proposed that, at the beginning of adolescence, girls experience a relative lowering of self-esteem resulting from the physical changes of puberty (menstruation is associated with both physical and psychological symptoms), together with psychosocial changes (the transition from primary to secondary school) and a growing awareness of being female in a society that emphasizes maleness, which may lead to worse self-rated health. Palacio-Vieira et al. (2008) explained that puberty had a stronger (negative) effect on HRQL in girls compared to boys. Sweeting and West (2003) accounted that girls may be challenged by the expectations of the traditional female role in combination with recent increases in

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educational expectations. Moreover, there are data indicating that girls experience a higher amount of perceived interpersonal stress and score higher on maladaptative coping strategies than boys (Hampel & Petermann, 2006).

The most interesting point is that girls scored higher in relations with friends and relations with teachers. This may be explained by assuming that boys and girls differ in the socialization patterns they have been exposed to. As a product of this process, girls emphasize aspects such as conflict avoidance, self-disclosure, playing near adults and greater conformity with them, whereas boys emphasize competitiveness, direct anger expression, playing far away from adults and less self-disclosure (Maccoby, 1998). There is also evidence that girls consult friends and adults about their problems during puberty to a greater extent than boys do (Okada, Suzue, & Jitsunari, 2010). All these aspects may have a differential effect in the quality of relationships.

Regarding age differences in HRQL, older adolescents obtained lower scores in vitality, physical and psychological well-being, relations with teachers, school work and global health than younger adolescents, which is in line with other studies that used a similar age range as the present paper (Levin et al., 2009; Nuviala et al., 2010; Simeoni et al., 2001). During puberty, tremendous changes with a potential negative impact on perceived health occur. Physical changes of puberty, striving for developing autonomy and moving away from parental influences, development of significant peer relationships, perceived stress derived from increasing academic demands and higher exposure to risky behaviours play a key role in this issue (Jozefiak, Larsson, & Wichstrom, 2009; Meulners & Lee, 2003).

With regard to age differences on M/E, younger adolescents (12-13 years) were more morning-oriented than older adolescents (14 to 16 years). This finding is in line with previous studies indicating that a shift towards eveningness occurs approximately at the age of 13 (Díaz-Morales & Gutiérrez, 2008; Kim et al., 2002; Yang et al., 2005).

Regarding gender, boys were more morning-oriented than girls. Nevertheless, gender differences in M/E have tended to be inconsistent. Some studies found no gender differences in this variable (Carskadon et al., 1993; Kim et al., 2002; Takeuchi et al., 2002) while other papers reported that girls were more morning-oriented than boys (Tonetti, Fabbri, & Natale, 2008; Warner, Murray, & Meyer, 2008), and others reported that boys were more morning-oriented than girls (Gaina et al., 2006; Yang et al., 2005). According to Randler (2007), this inconsistency may be explained by the use of large age-range samples: A large age range within a study produces smaller effect sizes, which, in turn, masks gender differences. Future studies are necessary to analyze the possible change of gender differences on M/E with age, as well as the differential impact of social and biological factors along the lifespan. For example, changes in pubertal status and in gender roles could be important during adolescence, whereas menstrual rhythm (or menopause) and gender/family/social roles could be relevant in the adulthood (Díaz-Morales & Sánchez-López, 2008; Randler & Bausback, 2010).

M/E was associated with HRQL. Evening-type adolescents scored lower than morning-types in vitality, physical well-being, psychological well-being, body image, relations with parents, relations with teachers, school work and global health. In general terms, neither-type scores were not statistically different from those obtained by morning-type adolescents.

A possible explanation for the poorer self-rated health among evening-type adolescents may be their more difficult adjustment to school life and accommodation to an early sleep schedule in comparison to morning-type adolescents. Several authors in different countries have reported that school-day start time is earlier for adolescents than for younger children and this change occurs concurrently with the pubertal shift on M/E (Carskadon, Wolfson, Acebo, Tzischinsky, & Seifer, 1998; Díaz-Morales & Gutiérrez, 2008; Kim et al., 2002; Yang et al., 2005). This advance of the school day, together with the fact that evening-types tend to have later bedtime and wake-up time than morning-types (Carskadon et al., 1993; Giannotti et al., 2002), have an effect on them producing a chronic sleep deprivation pattern that leads to daytime sleepiness, difficulty falling asleep, greater use of hypnotics, increasing risk of injuries, lower levels of alertness, attention problems and depression (Fredriksen, Rhodes, Reddy, & Way, 2004; Giannotti et al., 2002; Kim et al., 2002; Yang et al., 2005).

School performance is negatively affected as well (Beşoluk, 2011; Beşoluk et al., 2011; Escribano et al., 2012; Randler & Frech, 2009). These problems may lead to lower scores in vitality, physical well-being and psychological well-being. Moreover, poor school performance could lead to lower scores in relations with parents and relations with teachers. Another explanation may be personality differences between morning-types and evening-types. Morning-types tend to score higher in Stability, a metatrait comprised of Agreeableness, Conscientiousness and the reverse of Neuroticism (DeYoung et al., 2007) and tend to relate to authority in a respectful and cooperative manner and to behave in a formal and proper manner in social situations (Díaz-Morales, 2007). Evidence indicates the existence of associations between conscientiousness and agreeableness, health behaviours and a greater general health (Booth-Kewley & Vickers, 1994; Greven, Chamorro-Premuzic, Arteche, & Furnham, 2008), whereas social conformity may lead to better relations with parents and relations with teachers. Thus, personality could account for the association between eveningness and poor HRQL, at least in part.

One limitation of the study is its cross-sectional design. In order to apprehend the changes in M/E and HRQL over time, a longitudinal approach is desirable. The second limitation is the nature of the self-reported data. Although the instrument used in this paper to assess chronotype has

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an adequate external validity, the availability of physiological data may be interesting to confirm these findings. The third limitation is the lack of data about sleep parameters. It was discussed that sleep schedules may explain the poorer self-rated health among evening-type adolescents. The availability of data about these variables may help to examine that relationship. Nevertheless, it seems clear that a greater eveningness was associated with poorer HRQL among adolescents. Thus, M/E should not be ignored when plans for promoting health among children and adolescents are carried out.

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