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Perception of parents' physical activity as a positive model on physical activity of adolescents

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ABSTRACT

Physical activity (PA) promotes an adequate level of health in adolescents. The PA behaviors moderation is led by the adolescents' perception of their parents. We suppose that higher adolescents' perception of their parents' physical activity influences the physical activity spent in adolescents. The objective of this study was to determine the association between adolescents' perception of their parents' PA practice with adolescent's PA in a sample of public schools in the Morelos state of Mexico. We analyzed the information of 4625 adolescents from the baseline of a cohort study of students in public schools in Mexico. We evaluated adolescents' perceptions of their parents PA and PA practice of the adolescents. A logistic regression analysis stratified by sex was carried out to evaluate the association between adolescents' perceptions of their parents PA, and adolescents' PA. We found that the PA of female adolescents was associated with their perceptions' of both parents' PA (OR = 2.48; IC95% 1.84–3.35). Adolescents' perceptions of their mother's PA was associated with their PA (daughters OR = 1.69; IC95% 1.33–2.15; sons OR = 1.87 IC95% 1.41–2.45). In conclusion, adolescents' perceptions of their parents' PA practice were associated with higher adolescents' PA. Higher adolescents' perception of their parents PA may play an important role as a positive model for the adolescent's PA practice ($p < 0.001$). Finally, parental PA and the perceptions that adolescents have of their parents' PA must be considered in devising general PA programs.

1. Introduction

The National Health and Nutrition Survey of Mexico (ENSANUT-2012) has shown that physical activity prevalence is low in the general population and specifically in youth aged 10 to 18 years with a level not higher than 60.0%. The level of inactive youth reached 11.9% between 15 and 18 years of age, and just 2.5% of kids between 10 and 14 years of age were physically active. Furthermore, in adults, the prevalence of physically active people diminished 12.2% between 2006 and 2012. Low PA has been associated with higher morbidity and mortality (Medina et al., 2013; WHO, 2018, 2018).

The focus of this work is through the application of social learning theory, which has been previously evaluated to explain adolescent tobacco use (Collins and Ellickson, 2004). This theory is based in the establishment of social transmission of information is as a key phenomenon in the behavior evolution and the creation of traditions and culture. Among the social learning scenarios are learning responses to social stimuli, including learning trough imitate. The social learning can be conceptualized as situations in which stimuli that arise from other individuals have an important role in learning through associative processes. The associative mechanisms can result in information transfer of information and behavior from experienced to unskilled individuals (Lind et al., 2019).

Our hypothesis is based on Rotter's social learning (Rotter, 1954) and Bandura's (Bandura, 1977) theories. These behavioral models or lifestyles models related to PA for the present study are acquired considerate that learning has place through by social situations that are linked to necessities. In other words, these theoretical models establish that learning is modulated by other people. In our study, the PA behaviors moderation is led by the adolescents' perception of their

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parents. We suppose that higher adolescents' perception of their parents' physical activity influences the physical activity spent in adolescents.

The evaluation of PA perceptions is important because healthy behaviors are related to personal, environmental, and sociocultural factors. A positive perception of PA may be helpful in modifying lifestyle patterns at the general population level (Moreno-Collazos and Cruz-Bermúdez, 2015). Parents influence the practice of PA of their offspring, through the own offspring perception about parental PA practice (Schoeppe et al., 2016; Carson et al., 2015). This may be particularly true during adolescence when PA diminishes; parents and tutors may promote and stimulate adolescents PA if they themselves exercise regularly. Involvement in physical activity during childhood and adolescence at an adequate level may prevent obesity and other chronic diseases during adulthood (Kaseva et al., 2017).

However, this association is stronger if the parents' PA not just is performed currently, but also was performed in the past, which shows that the current parental physical activity is associated with teenagers, but when physical activity in the past of parents included, the association is 6 times high (Destro-Christofaro et al., 2018). In fact, the influence of the parents' PA on their childrens' PA may continue until adulthood (Kaseva et al., 2017). Previous studies have pointed out the benefits of the regular practice of moderate and vigorous PA during adolescence (Wen et al., 2011). Even more, the regular practice of exercise during adolescence has been positively associated with good health in adulthood (Malina, 2001). The benefits of PA include an increase in quality of life and general well-being, particularly in adolescents whose participation in PA improves their physical performance and health (Eberth, 2010). Furthermore, PA promotes good mental health, psychosocial skills, and academic achievements (Biddle et al., 2004; Strong et al., 2005).

The mechanism through which parents' PA is associated with their offspring's PA can be of a biological and psychosocial nature. Studies with tweens have shown that part of children's PA variability is related to genetic factors (Joosen et al., 2005). However, participation in PA is also associated with psychosocial aspects, such as parental socialization skills, parental commitment to PA and the time committed to PA that parents share with their kids (Cheng et al., 2014; Bauman et al., 2012). The objective of the present study was to determine the association between adolescents' perceptions of their parents' PA practice with adolescents PA practice in a sample of public schools in the Morelos state of Mexico.

2. Methods

Physical activity and socio-demographic information was collected from students in the public schools of Morelos state in Mexico and is part of the baseline data of a cohort study. The original sample was composed of 4625 students of public schools; students from high schools and colleges who agreed to participate after signing an assent or consent letter with their parents' to participate in the study, the participation rate was 92.5%. The information was collected between 2004 and 2005. The study was approved by the research, biosecurity and ethics committees of the National Institute of Public Health of Mexico, detailed information can be consulted in the previous study (Sánchez-Zamorano et al., 2007).

2.1. Adolescent physical activity

PA information was obtained via a self-report questionnaire that was validated for Mexican children and adolescents which was validated and translated from the Youth Activity Questionnaire (YAQ) (Wolf et al., 1994; Hernández et al., 2000). The questionnaire had the following questions: How many time at week do you spend playing soccer, volleyball, biking, rollerblading, running, basketball, dancing, cleaning the house, tennis, swimming, and baseball. For the study, the variable of time of practice of physical activity was formed from the sum of the time per week of the aforementioned activities reported by the adolescent. According to the type of PA, were constructed to variables, time per week of vigorous PA (soccer, volleyball, biking, running, basketball, tennis and swimming) and time per week of moderate PA (dancing, cleaning house, baseball, rollerblading) (WHO, 2018), this variable was operationalized in h/week. From these variables, a dichotomous variable of adequate physical activity was constructed (at least 420 min a week of moderate and/or vigorous PA vs. < 420 min a week) based on the criteria established by the WHO for physical activity in adolescents (WHO, 2018).

2.2. Adolescents' perceptions of their parent's physical activity

Adolescents provided information about the frequency and duration of their parents' PA. They answered the following question: How often does your father (mother) perform PA? (Including dancing, walking, etc.) Possible answers included: never, less than half an hour, from half an hour to two hours, from two to four hours per week, from 4 to 6 h per week, and an hour or more per day.

We used WHO guidelines to classify adolescents' perception of their parents' PA as adequate or not (PA adequate: those parents who performed four or more hours of PA per week) (WHO, 2018). We asked to adolescent for information about their perception of the PA of each parent independently, for frequency and duration of activities such as dancing, walking, etc. Duration was categorized as never, less than half an hour, from half an hour to two hours per week, from two to four hours/week, from four to six hours/week, one hour/day or more, I do not know or I do not see my father and/or my mother perform any physical activity (adolescents who gave the last answer were eliminated from the present analysis). With the information collected, we obtained three variables of adolescents' perceptions of their parents PA: a) adequate PA of their father only (no/yes); adequate PA of their mother only (no/yes), and c) adequate PA of both parents (none, some of the parents, both).

2.3. Co-variables of interest

We obtained adolescents' characteristics, such as BMI (kg/m2) and nutritional status by CDC criteria (Kuczmarski et al., 2002). Self-perception of nutritional status by body shapes proposed by Stunkard (Stunkard et al., 1983; Acosta García and Gómez Peresmitré, 2003) validated for the Mexican population. These shapes are enumerated from 1 to 9, where 1 represents the thinnest shape and 9 the biggest one (Cortés-Martínez et al., 2009).

For the present study, the first three shapes were classified as normal weight (1 to 3), the fourth to sixth shapes as overweight, and the seventh to ninth shapes as obese. We collected information about the adolescents schooling (secondary school, high school, and college), smoking, alcohol, and drug habits (yes/no), depression symptoms on the Zung scale (none, low, moderate, severe), and opinions about exercising (I dislike exercising, I do not care about exercising, I like exercising).

We got co-variables of interest from the parents and household, such as: 1) parents' marriage (parents living together, separated, other); 2) parents schooling (What did your father study? Nothing, completed elementary school, did not complete elementary school, completed secondary school, did not complete secondary school, completed high school, did not complete high school, technical school, college, postgraduate studies, I do not know, I have no dad (mother)); 3) father's occupation (stable employment, unstable employment); 4) mother's occupation (stable employment, unstable employment); 5) mother in household (yes/no); 6), involvement of family and friends in PA with the adolescents (never, sometimes, a lot of times); 7) socioeconomic levels obtained through principal components analysis (How many people live in your household? How many people economically

contribute to your household? Floor material? How many bedrooms are there in your household? Tubing water disposal, sewer system disposal, and electric appliances ownership?). The socioeconomic-level index was divided into tertile; where tertile 1 corresponded to Low Socioeconomic Status (SES), tertile 2 to medium level SES, and tertile 3 to high SES. We included five variables based on family APGAR (Smilkstein et al., 1982):a) I feel that I count with family support, b) problems are spoken about within the family, c) important decisions are made as a family, d) I am satisfied with the time we spend as a family, and e) I feel that my family loves me. Each variable included in the family APGAR was analyzed separately to obtain an index of family well-being (Tertile 1: Low, Tertile 2: medium, Tertile 3: High).

2.4. Statistical analyses

Differences of the adolescents PA practice (mean time) and % of PA adequacy between selected characteristics among gender were evaluated; for the mean time of PA practice we used T" test or anova test and Chi2 test for the % of PA adequacy. A significant difference was considered when the p value corresponding to the estimator was < 0.05. We performed logistic regression models to analyze the association between adolescents' participation of their parent's PA adjusting for co-variables, such as parents' marriage, father's occupation, mother's occupation, involvement of family and friends in PA with the adolescents, socioeconomic status, family environment index, depression symptoms, smoking, alcohol intake, BMI, and physical activity perceptions. All analysis was performed by STATA 14®.

3. Results

We interviewed 4625 students from the high schools in Morelos, Mexico. Of the total sample, 51.8% of them were female and 48.2% were male between 12 and 17 years of age. Their mean age was 13.5 years (SD 1.4). Although age mean was similar for boys and girls standard errors were different (1.5 vs. 1.4, respectively), "p" value = 0.724. The males reported a significantly greater value of time spent in moderate/vigorous PA than the females (average of 12.3 h/w vs. 10.5 h/w, respectively). Similarly, the prevalence of males who were considered physically active was greater than the females (63.4% vs. 54.9%, respectively) (Fig. 1).

The distribution of mean hours that adolescents spent and percentage of adequate physical activity practice varies among some variables. Female high school students spent more hours in PA than adolescent women from colleges and universities. Similar results were found in adolescents who reported that liked physical activity. On the other hand, male adolescents who did not consume alcohol practiced on average more hours of PA than male adolescents who reported consumption of alcohol. As with the females, male adolescents who reported liking PA had a higher number of hours participating in PA than male adolescents who did not like PA or reported that they were indifferent to PA (13.1 h/s vs. 12.2 h/s vs. 10.42 h/s, $p < 0.001$ value, respectively). In relation to body mass index, we observed a greater proportion of male adolescents who reported being physically active ($p = 0.024$). We did not find statistically significant differences in the rest of the evaluated variables (Table 1).

In the distribution of average time (hours/week) invested in PA by gender, according to parental and household characteristics, we can observed that adolescents spent in PA a higher average of hours by week when they perceived that their mother and father spent more time participating in PA; this phenomenon was observed in both male and female adolescents. Adolescents' positive perceptions of their parents PA, adolescents with family members or friends insisting that they participate in PA, adolescents with confidence to talk about their problems with their parents and a high level on family satisfaction index contributed to a greater prevalence of x that participated in PA more hours by week, independently of gender (Table 2).

The logistic multiple analyses show a higher association between adequate level of adolescents' perception of their parent's PA and adequate practice of PA of the adolescents. Female adolescents who perceived that one or both of their parents had an adequate level of PA had a higher possibility of having an adequate level of PA themselves ($OR_{one\ vs\ none} = 1.56$ IC95%1.23–1.98; $OR_{both\ vs\ none} = 2.48$ IC95% 1.84–3.35, respectively; tendency p value < 0.001) than female adolescents who perceived that their parents did not have an adequate level of PA. The same tendency was observed in male adolescents ($OR_{one\ vs\ none} = 1.80$ IC95%1.39–2.36; $OR_{both\ vs\ none} = 2.15$ IC95% 1.49–3.09, respectively; tendency p value < 0.001). Although both parents' participation in PA influenced the adolescents' PA, the association was stronger between the perception of mothers' PA and their offspring's PA (Fig. 2).

4. Discussion

The results of the present study showed that adolescents' positive perception of their parents' PA are higher associated with having them an adequate level of PA. These findings are similar to Voss and Sandercock's (2013) study in relation to both parents' PA, children's perception, and adolescents' PA in England. These authors found that children's perceptions of their parent's participation in PA is more important than that of their parents' direct report of PA.

However, other authors (Schoeppe et al., 2016; Voss and Sandercock, 2013) have explored the association between each parent's PA by adolescents' gender, and it has been observed that there was a greater influence of the father's PA than the mother's PA on their male and female offspring. Furthermore, some studies have shown that parents' participation in PA has a greater influence on female adolescents' PA than on male adolescents' PA (Schoeppe et al., 2016; Voss and

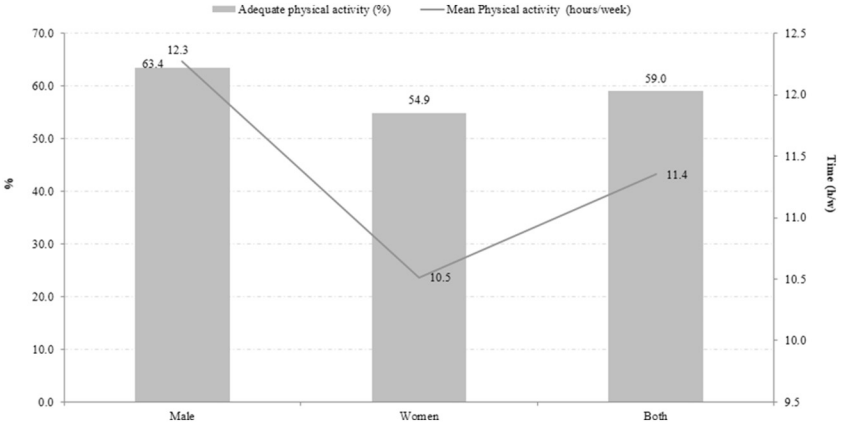


Fig. 1. Mean and adequate physical activity in adolescent by sex. Morelos, Mexico, 2004.

Table 1
Distribution of adolescents PA practice (h/w and % PA adequacy) by selected characteristics according to gender in Morelos, Mexico.

Characteristics	Females					Males				
	n[a]	Average of hours of physical activity	"p" Value[b]	Adequate physical activity %	"p" Value [b]	n [a]	Average of hours of physical activity	"p" Value[b]	Adequate physical activity %	"p" Value [b]
Body mass index										
Normal	1453	9.13	0.182	54.03	0.38	1281	10.5	0.172	61.9	0.024
Overweight	567	9.69		55.73		479	11.01		63.47	
Obesity	223	9.85		58.74		318	11.34		70.13	
BMI self perception										
Normal	886	10.73	0.568	55.98	0.840	1182	12.41	0.761	64.30	0.986
Overweight	1020	10.66		55.88		558	12.56		64.70	
Obesity	283	10.16		54.06		280	12.11		64.29	
Schooling										
High-school	1420	11.15	< 0.001	55.42	0.512	1399	12.64	0.122	63.05	0.552
College/university	826	9.77		54.00		685	12.04		64.38	
Tobacco consumption history										
No	2033	10.64	0.629	54.60	0.596	1853	12.5	0.391	64.17	0.078
Yes	207	10.34		56.52		235	12		58.30	
Alcohol consumption history										
No	1767	10.78	0.089	54.44	0.379	1710	12.62	0.037	63.86	0.241
Yes	469	10.08		56.72		358	11.6		60.61	
Drugs consumption history										
No	2144	10.66	0.075	55.08	0.270	1988	12.39	0.241	63.25	0.119
Yes	61	8.1		45.45		52	14.24		77.78	
Depression symptoms report										
None/low	423	9.06	0.441	54.14	0.809	384	11.31	0.260	67.97	0.117
Moderated	1524	9.33		54.79		1400	10.64		62.71	
Severe	299	9.78		56.52		300	10.41		61.33	
Adolescent's opinion about physical activity practice										
I dislike it	85	7.87	< 0.001	40.24	< 0.001	71	12.2	< 0.001	64.69	< 0.001
I do not care	614	8.99		47.34		500	10.42		56.16	
I like it	1645	11.4		59.48		1576	13.1		67.21	

[a] The "n" values are different between variables because missing values.
[b] "P"value of anova test and "t" test by distribution of mean hours per week of physical activity among characteristic, and Chi2 test by distribution of % of adequate physical activity.

Sandercock, 2013). These findings are in contrast to our findings because the PA of male adolescents in our study was associated with theirs' perception of mother's PA. The influence of mothers in their offspring PA is different from fathers' influence. A possible explanation for this phenomenon is that mothers are more involved in their offspring activities and consequently spend more time with them (García-Ferrando, 1993). In the present study we found that 51.4% of adolescents reported that their mother's activities were mainly performed at home, which may indicate that adolescents of our sample of study spend more time with their mother than with their father. Moreover fathers of the present study had most of their activities outside home, which support this explanation.

Other studies from the Latin American population have reported that the mothers' PA influences the adolescents' PA; the Brazilian study, in particular, found that the mothers' PA during their lifetime had a greater influence on the adolescents' PA. However, this study did not stratify the adolescents' PA by gender and their measure the parent's PA (Destro-Christofaro et al., 2018). Cohort studies have pointed out similar results to our study findings, where parents' who had high levels of PA influenced an increase in adolescents' PA until they reached 24 years of age (Kaseva et al., 2017).

Our hypothesis is based on Rotter's social learning (1954) and Bandura's (1977) theories. These behavioral models or lifestyles related to PA for the present study are learned by social situations that are linked to necessities. Learning is moderated by other people. In our case, the moderation is led by the adolescents' parents. Rotter states that individuals consider the consequences of their actions in each situation, and they act based on their beliefs. This author assumes that people act as a consequence of their thinking, and the results provide reinforcement of some behaviors (Rotter, 1954).On the other hand Bandura (1977) postulates that behavioral learning is determined by people's environment. We can postulate that social learning theory support the results of this work. In the study of perception, we must consider the postulated by Berger and Luckmann (1967), where they mentions that the "reality" of a person can be different from the "reality" of another person, influenced by the great diversity and amplitude in the environment in which young people develop, the legitimization of learning and internalization of this. Applying it to the present study, the perception that adolescents have of PA of their parents does not necessarily reflect the reality of their physical activity, but the purpose in this study is precisely what they are perceiving in their reality, according PA of parents, and that is relating to the processes that are carried out in their family environment, and that in some way influences the lifestyles of adolescents in relation to the learning that parents do.

In Mexico, 80% of child and 35% of adolescents don't comply with the recommendations of PA (Medina et al., 2018), therefore, the promotion of physical activity in adolescents must include parents' participation because their PA practices may influence positively their offspring PA. Including parents in PA programs may impact acquisition of healthy habits in young people and adults (Sánchez-Miguel et al., 2015). Foster et al. (2018) through a review concludes that prevention and treatment of obesity in adolescents, through physical activity including parents may be an adequate approach to control weight in young people (Foster et al., 2018).

4.1. Study limitations

Our study had some limitations. The nature of the cross-sectional design does not allow us to infer a causal relationship between

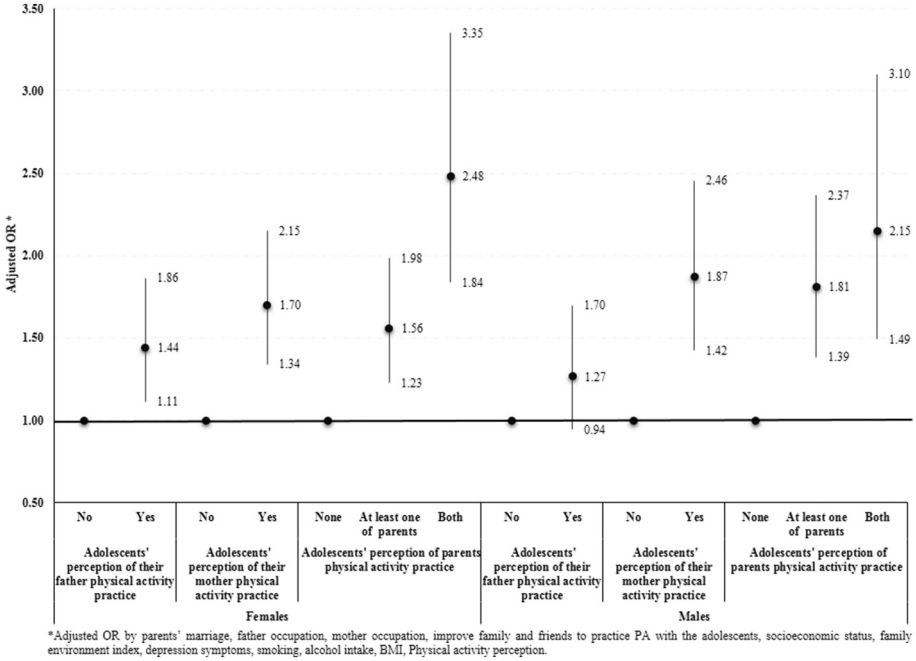
Table 2
Distribution of adolescents PA practice (h/w and % PA adequacy) by selected characteristics of parents and home according to gender, Morelos, México 2004.

Characteristics	Female					Male				
	n[a]	Average of physical activity (hours/week)	"p" Value[b]	Adequate physical activity %	"p" Value[b]	n[a]	Average of physical activity (hours/week)	"p" Value[b]	Adequate physical activity %	"p" Value[b]
Parents' marriage status										
Living together	1348	10.43	0.068	54.49	0.495	1250	12.33	0.031	65.04	0.024
Separated	469	10.47		55.86		410	13.40		68.78	
Other	220	11.81		58.64		208	11.67		57.69	
Father's economic activity										
With permanent job	1122	10.99	0.002	59.80	< 0.001	1051	12.80	0.191	67.65	0.027
Without permanent job	651	9.99		51.61		586	12.13		61.60	
I do not know/no parents	379	10.39		49.87		349	12.09		62.46	
Mother's economic activity										
Household	1094	10.06	0.002	52.93	0.024	1069	12.15	0.116	64.08	0.841
Economic activity other than homemaker	993	11.29		58.81		854	12.62		65.22	
I do not know/no parents	101	10.34		57.43		94	13.88		65.96	
Adolescents' perception of an adequate physical activity practice of their father										
No	1054	9.56	< 0.001	50.95	< 0.001	1016	11.75	< 0.001	60.93	< 0.001
Yes	623	12.17		65.01		480	14.10		74.58	
Adolescents' perception of an adequate physical activity practice of their mother										
No	1211	9.49	< 0.001	49.63	< 0.001	1201	11.23	< 0.001	58.62	< 0.001
Yes	801	12.70		65.54		600	14.32		76.67	
Adolescents' perception of an adequate physical activity practice of their both parents										
None	1082	9.40	< 0.001	49.08	< 0.001	1109	11.14	< 0.001	57.35	< 0.001
One of both parents	622	11.45		60.77		498	13.53		71.49	
Both parents	401	13.26		68.83		291	14.79		79.38	
Your relatives and friends recommend you practice physical activity										
Never	808	9.16	< 0.001	58.54	0.001	784	11.54	< 0.001	68.37	0.001
Some times	1064	10.33		55.73		945	11.94		62.01	
A lot of times	417	11.73		47.24		363	13.55		61.43	
Households socioeconomic level[c]										
Low	736	9.98	< 0.001	50.00	< 0.001	633	12.10	0.078	60.82	0.034
Medium	691	10.82		56.44		639	12.24		66.82	
High	698	11.81		62.03		751	13.05		66.71	
Variables of family satisfaction family environment index[d]										
Low	698	10.66	0.021	54.30	0.241	690	11.94	0.002	59.42	< 0.001
Medium	761	10.13		54.14		667	12.05		62.82	
High	715	11.30		58.04		646	13.42		70.12	

[a] The "n" values are different between variables because missing values.
[b] "P" value of anova test and "t" test by distribution of mean hours per week of physical activity among characteristic, and Chi2 test by distribution of % of adequate physical activity.
[c] The index of socioeconomic level was built by principal components analysis, the meaning of each category could be interpreted as follows: Low (Many people live at home, few of them contribute money to family spending, the floor is land, they use few rooms to sleep, they do not have piped water or drainage and they have few electrical appliances), High (few people live at home, several of them contribute money to family spending, the floor is slab, they use several rooms to sleep, they have piped water and drainage, and they have several appliances. Medium level is between the previous two).
[d] The family environment index was built by principal components analysis, the meaning of each category could be interpreted as follows: Low (you almost never get help from the family, they talk among you, they make decisions together, you are satisfied with family time and you feel that they love you), Medium (sometimes you receives help from the family, they talk among you, they make decisions together, you are satisfied with family time and you feel that they love you) an High (you almost always get help from the family, they talk among you, they make decisions together, you are satisfied with family time and you feel that they love you).

adolescents' perceptions of their parents' PA and their own PA. However, there are cohorts plus cross-sectional studies that have found similar results. For instance, we can state that there is a higher association between adolescents' perceptions of their parents' PA and their own PA. The only variable on sexual maturation used was menarche or spermarchy presentation, the objective of the project was not about sexual health, but other variables were included, we know that this represents a limitation, but we recognize it and that is why the variable is managed as a presentation of the menarche or spermarchy and not as puberty.

Another limitation is the possibility of bias by PA questionnaires. Adolescents PA could be under or overestimated, in study of Vanhelst et al. (2018) estimated that 45.0% of adolescent report PA correctly, and the other under or overestimated PA. Adolescents may over or underestimated PA, however since our results are consistent to other studies we consider PA estimation error may be random. Random error causes an underestimation on odds ratios values but no on association direction. Future studies with objective instruments such as accelerometers to confirm our findings are recommended. We think combination of PA questionnaires and accelerometers will be helpful to



*Adjusted OR by parents' marriage, father occupation, mother occupation, improve family and friends to practice PA with the adolescents, socioeconomic status, family environment index, depression symptoms, smoking, alcohol intake, BMI, Physical activity perception.

Fig. 2. Asscoiation between adolescents' pereception of adequate physical activity of their parents and their own physical activity practice. Morelos, Mexico, 2004.

design PA programs for adolescents. About adolescents' perception of their parents' physical activity they were not asked specifically for each sporting activity, recreational or common. But we think that young people perception of their parents physically activity can distinguish if parents are active or not.

5. Conclusion

In conclusion, adolescents' perception of their parents' PA plays an important role in determining adolescents' PA as a positive model to learn about a healthy lifestyle. Socioeconomic status is another factor that together with a positive model must be considered in the design and evaluation of programs and interventions to improve adolescents' PA. Moreover, parents' PA and adolescents' perceptions of their parents' PA must be assessed as promoters or obstacles to adolescents' PA.

Declaration of competing interest

The authors have no conflicts of interest.

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