

## The associations of religiosity and family atmosphere with lifestyle among Saudi adolescents

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### ABSTRACT

There have been gradual sociocultural changes in Saudi Arabia due to globalization. This allows a unique opportunity to examine religiosity and family atmosphere in relation to lifestyle among Saudi adolescents. In this cross-sectional study, 2067 school students (grades 7–12) from 32 randomly selected schools in Al-Qassim, Saudi Arabia were enrolled. Perceived religiosity, family atmosphere, lifestyle (e.g., physical activity, diet, screen time, obesity, and smoking), demography, parental attributes, and religious practices were assessed with validated scales and questions. A risk profile was created from the lifestyle variables (none, one, two, or  $\geq$  three), and the students were grouped into low versus high religiosity and low versus high family atmosphere using a median split. Multinomial regressions were used to model the lifestyle risk profile. The mean age  $\pm$  standard deviation was 15.5 years  $\pm$  1.7, and 35% were girls; 28% had no risk factors, 32% had one, 25% had two, and 15% had  $\geq$  3. After adjustment, both low religiosity and low family atmosphere were significant correlates of the lifestyle risk profile (e.g.,  $\geq$  3 risk factors: religiosity OR = 2.9, 95% CI: 2.1, 4.0; family atmosphere OR = 2.0, 95% CI: 1.5, 2.8). Those with both low religiosity and low family atmosphere were more likely to have a higher lifestyle risk profile than those who scored high in religiosity and better in family atmosphere (e.g.,  $\geq$  3 risk factors: OR = 5.9, 95% CI: 3.7, 9.5). Hence, higher religiosity and better family atmosphere are associated with less risky lifestyles among Saudi adolescents.

### 1. Introduction

Several family-related factors, such as parents' education, occupation, and socioeconomic and marital status, have been shown to be associated with adolescents' lifestyles (Haines et al., 2016; Lima-Serrano et al., 2017). Adolescents from less affluent families are less likely to eat vegetables and more likely to watch television than adolescents from more affluent families (Richter et al., 2009). Family atmosphere and parent-adolescent relationships also impact adolescent behavior (Haines et al., 2016). Adolescents with a good family atmosphere are less likely to engage in risky behaviors such as smoking (Lima-Serrano et al., 2017), and adolescents who receive active parental support are more likely to meet guidelines for diet, physical activity, and screen time (Richard et al., 2016).

Religion also plays an important role in the lifestyle of adolescents. Studies from around the world have shown that higher religiosity is associated with exhibiting fewer risky behaviors and more healthy behaviors; for example, less screen time and more sports (Malinakova et al., 2018; Rew & Wong, 2006). A large systematic review showed that the majority of studies reported a positive association between religiosity and various health behaviors (e.g., diet and exercise) among adolescents (Rew & Wong, 2006).

Saudi Arabia is an ideal place to examine the relationship between religiosity and lifestyle among adolescents. Adolescents represent a large portion of the population [e.g., 33% of the population are under the age of 25 (General Authority for Statistics Saudi Arabia, 2019)]. Saudi Arabian society is deeply conservative and is guided by the strict principles of Islam, but those values are constantly being challenged

*Abbreviations:* SOFA, Short Scale of Family Atmosphere.

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among youth, particularly post-millennial adolescents, who spend much of their time on the Internet and are exposed to Western secular values. Published studies have indicated that a significant portion of Saudi adolescents do not have a healthy lifestyle (AlBuhairan et al., 2015; Rajab et al., 2020). “Jeeluna,” a large national study, reported an overweight/obese prevalence of 30% among adolescents (AlBuhairan et al., 2015). A smaller study showed that 3.5% of its participants were smokers, 45% had unhealthy diets, 20% were inactive, and 64% spent >3 h daily in front of screens (Rajab et al., 2020).

There are few Saudi studies on family factors and almost none on religiosity in relation to adolescent behaviors. The assessment of family factors and health behaviors was not comprehensive in those studies, so the evidence is limited (Alazzeah et al., 2018). Religiosity has been assessed mostly in the context of self-esteem, happiness, and mental health, but not with respect to lifestyle or behaviors (Abdel-Khalek, 2009, 2013, 2014). The objectives of this current study among Saudi adolescents were to 1) assess whether family factors (e.g., socioeconomic status, parental marital and employment status, and family atmosphere) or self-rated religiosity are associated with a lifestyle risk-factor profile, and 2) measure the combined effect of family atmosphere and religiosity on a lifestyle risk-factor profile. We hypothesized that low family atmosphere and low religiosity would both be independently associated with a higher lifestyle risk-factor profile.

## 2. Materials and methods

### 2.1. Design and sample

We conducted this cross-sectional study between March and April of 2019 in governmental schools in Al-Qassim, Saudi Arabia. We limited our data collection to four cities: Buraydah, Unaizah, Al-Rass, and Al-Bukairyah. The directorate of the Ministry of Education in Al-Qassim approved the study protocol, which was subsequently reviewed and approved by the regional research ethics committee at the Ministry of Health (approval number 1440/1513459).

### 2.2. Sample size

The total population of adolescents (age: 10–19) in Al-Qassim in 2018 was 215,928 (General Authority for Statistics Saudi Arabia, 2019). The study needed a minimum of 1526 participants in order to estimate the study outcomes with a 2.5% margin of error and a 95% confidence level. This means that if the study were to be repeated 100 times, population estimates would be 2.5% above or below the data found in 95 out of 100 study samples (Taherdoost, 2017).

### 2.3. Sampling frame

We chose a stratified, cluster random sampling based on city, school level (intermediate: grade 7 to 9; secondary: grade 10 to 12), and school type (male and female). A list of schools in each of the four cities was obtained from the Ministry of Education (342 schools in Buraidah, 78 schools in Unaizah, 42 schools in Al-Bukairyah, and 59 schools in Al-Rass). We selected 8 schools from each city (4 from each school level, and 4 from each school type), resulting in a total of 32 schools. In collaboration with the school administrators, we chose one classroom from each intermediate grade and each secondary grade within each school. We invited all students in the selected classrooms to participate. We aimed to enroll an average of 75 students per school (total: 2400; 75\*32).

### 2.4. Pretesting

Prior to the actual study, the survey was administered to five adolescents who otherwise would have been eligible for the study in order to ensure that the participants understood the questions clearly and that

the response options of the included questions were relevant and mutually exclusive. Additionally, the pretesting helped determine the average time a participant needed to complete the survey (Ruel et al., 2015).

### 2.5. Study procedures

Trained research assistants visited each school twice. On the first visit, they explained the study to the school administrators, sought their cooperation, visited selected classrooms, explained the study idea and procedure, and invited the students to participate; they gave informed consent forms to be signed by students' legal guardians. In a subsequent visit, they administered the survey to the students, except those whose parents did not consent (i.e., passive informed consent approach: parental approval is assumed if the informed consent form is not returned back with rejection) (Eaton et al., 2004). It took the participants around 20–30 min to complete the paper-based survey.

We approached approximately 2400 students on the first visit; 533 were not present during the second visit or did not give consent (response rate = 80%). Out of 2067 who filled out the survey; 315 records had missing data on key variables; therefore, the remaining 1752 were the focus of this paper.

### 2.6. Outcome

We assessed 5 lifestyle risk factors: body mass index, screen time, physical activity, diet, and smoking status. We calculated body mass index from self-reported height and weight and categorized participants into normal, overweight, and obese according to the Centers for Disease Control growth charts (El Mouzan et al., 2008). We assessed screen time as the number of hours per day spent using any type of electronic device (i.e., television, computer, smartphone, etc.). We assessed the following with self-rated questions using 4-point responses: physical activity (very active, somewhat active, somewhat inactive, and very inactive) and diet (very healthy, somewhat healthy, somewhat unhealthy, and very unhealthy). We also asked each participant whether he/she was a current smoker (yes/no). In order to create a lifestyle risk profile, we first made each of the 5 variables binary as follows: 1) overweight/obese vs. normal, 2) screen time:  $\geq 6$  vs.  $<6$  h per day, 3) physical activity: very inactive vs. all other groups, 4) diet: very unhealthy vs. all other groups, and 5) smoker vs. non-smoker. We calculated a summary lifestyle risk-factor score (0–5) and categorized it into 0 (no risk factors), 1, 2, and 3 or more risk factors.

### 2.7. Exposures

We assessed family atmosphere with the 10-item Short Scale of Family Atmosphere (SOFA), which was developed in English (Molloy & Pallant, 2002) and later translated into Arabic and validated (Abdel-Khalek, 2016). The items included questions such as, “I respect my parents,” “I have a happy and close relationship with my mother/my father,” and “My house is full of tension and disagreements.” Each item was rated on 5-point scale from strongly disagree to strongly agree. The range of scores was between 10 and 50, with a higher score indicating a better family atmosphere. SOFA exhibited a strong internal consistency across the items. We calculated the total score for our participants and categorized them as either above (high) or below (low) the median score.

We assessed self-rated religiosity with a single item, “What is your level of religiosity?” which had been translated into Arabic and used in previous studies (Abdel-Khalek, 2006). The single item was rated between 0 and 10, with 0 being very low and 10 being very high religiosity. We categorized the participants as either above (high) or below (low) the median score.

## 2.8. Co-variables

We assessed city, school level, parental socioeconomic status (rich/upper-middle class vs. lower-middle class/poor), parental marital status (currently married vs. not married), father and mother employment (yes vs. no), and participant age and gender.

## 2.9. Statistical analysis

We began the analysis by running the descriptive statistics for the included variables. We assessed normality of continuous variables and presented their means and standard deviations (SD). We reported the frequency (%) for categorical variables. We graphed the lifestyle risk factors individually and collectively. We examined the bivariate associations between exposures (i.e., family atmosphere and religiosity) and the outcome (i.e., lifestyle risk-factor profile) with a chi-square test.

We adopted a multilevel multinomial logistic regression to model the lifestyle risk profile. We took the multilevel approach because data had a nested structure (i.e., participants were clustered in schools and schools were clustered in city). Therefore, level one represented cluster-level data, whereas level two represented individual-level data. The general equation for our model was

$$\eta^{(m)}_{ij} = \alpha^{(m)} + \beta^{(m)} x_{ij} + \xi^{(m)}_j + \delta^{(m)}_{ij}$$

where  $m$  denoted the outcome variable (i.e., lifestyle risk profile),  $j$  denoted the cluster (i.e., city and school), and  $i$  denoted the individual of the  $j$ th cluster. Finally,  $\xi_j$  and  $\delta_{ij}$  were vectors of random errors representing unobserved heterogeneity at cluster and individual level, respectively (Grilli & Rampichini, 2007).

We built our model in three steps. In the first step, cluster-level variables were entered (i.e., level one variables) to determine whether there was a cluster effect in the data. Although family was not a cluster in our study, we entered family characteristics (i.e., socioeconomic status, parental marital status, parental employment status, and family atmosphere) as a separate step (i.e., Model 2) to determine how all these family variables as a group influenced the outcome. In the final step, (i.e., Model 3), we entered the individual characteristics (i.e., age, gender and religiosity). For each model, we reported  $-2$  Log likelihood, chi-square value, degrees of freedom, and  $p$ -value.

Each step contributed significantly to the model building. Therefore, the final model contained all the variables mentioned above. We reported the odds ratio and the 95% confidence interval for the exposures of interest (i.e., family atmosphere and religiosity). Since both exposures had a significant association with the lifestyle risk-factor profile, we ran an additional model where the two exposures were combined [i.e., high family atmosphere/high religiosity (reference), high family atmosphere/low religiosity, low family atmosphere/high religiosity, and low family atmosphere/low religiosity], but other covariates were kept the same. We used a two-sided test with an alpha of 0.05.

## 3. Results

The sample mean  $\pm$  standard deviation age was  $15.6 \pm 1.7$ ; 65% were boys. Ninety percent (90%) reported that their parents were currently married, and 64% reported their socioeconomic status to be rich/upper-middle class; a respective 79% and 37% reported their father and mother were employed (Table 1). A little over a quarter (28%) of the sample was overweight/obese, and one-third (33%) had 6 h or more per day of screen time. The median for family atmosphere was 43 (range: 15–50), and 7 (range: 0–10) for religiosity.

Twenty-one percent (21%) reported being very physically inactive, and 44% reported having a very unhealthy diet. Only 5% were current smokers. Twenty-eight percent (28%) did not have any of the 5 risk factors, 32% had only one, 25% had two, and 15% had 3 or more (Fig. 1A and B).

**Table 1**

Descriptive statistics of Saudi adolescents in Al-Qassim (n = 1752).

|                            | Sample size | Mean (SD)   | Percentage |
|----------------------------|-------------|-------------|------------|
| Age                        | 1752        | 15.6 (1.69) |            |
| Gender                     |             |             |            |
| Male                       | 1133        |             | 64.7       |
| Female                     | 619         |             | 35.3       |
| School level               |             |             |            |
| Intermediate               | 862         |             | 49.2       |
| Secondary                  | 890         |             | 50.8       |
| Socioeconomic status       |             |             |            |
| Rich/upper-middle class    | 1124        |             | 64.2       |
| Lower-middle/working class | 628         |             | 35.8       |
| Parents' marital status    |             |             |            |
| Married                    | 1575        |             | 90.1       |
| Not married                | 174         |             | 9.9        |
| Father's employment        |             |             |            |
| Employed                   | 1382        |             | 78.9       |
| Not employed               | 370         |             | 21.1       |
| Mother's employment        |             |             |            |
| Employed                   | 656         |             | 37.4       |
| Not employed               | 1096        |             | 62.6       |

Both family atmosphere and religiosity were significantly associated with the lifestyle risk-factor profile. For example, 66% of those who reported 3 or more risk factors had a religiosity score below median, while it was only 37% among those with no risk factors. Similarly, 68% of those who reported 3 or more risk factors had a family atmosphere score below median, while only 49% of those with no risk factors had a low family atmosphere score. (Table 2).

Each of the successive models of the lifestyle risk-factor profile was significantly better than the previous one, indicated by the increases in the model chi-square values. For example, the variables entered in Model 3 contributed together to a difference that was statistically significant above and beyond the variables in Model 2 (difference in chi-square = 120.7,  $df = 9$ ,  $<0.001$ ) (Table 3).

The adjusted analysis showed that the odds of having a low religiosity score incrementally increased across the categories of lifestyle risk factors; the odds ratio for low religiosity was 1.3 (95% CI: 0.99, 1.64) for one risk factor, 2.8 (95% CI: 2.11, 3.65) for two, and 2.9 (95% CI: 2.12, 4.04) for three or more, compared to those who had no risk factors. A similar pattern was present for family atmosphere; the odds ratio for low family atmosphere was 1.4 (95% CI: 1.08, 1.79) for one risk factor, 1.6 (95% CI: 1.18, 2.05) for two, and 2.0 (95% CI: 1.46, 2.82) for three or more, compared to those who had no risk factors (Table 4).

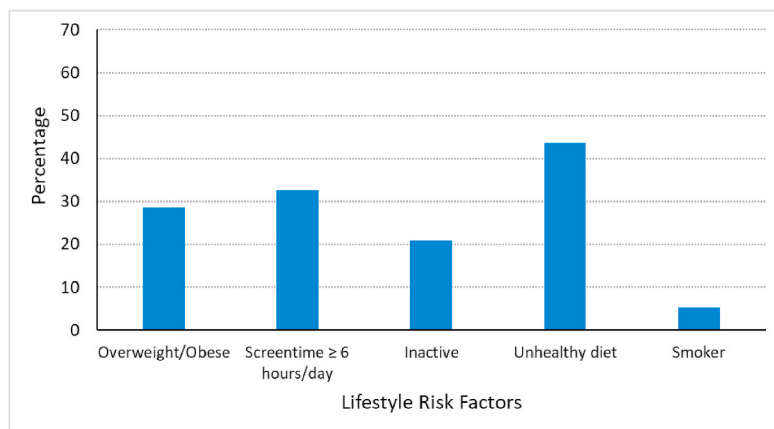
The odds of having a low score on both family atmosphere and religiosity was 1.8 times higher for one risk factor, 4.4 for two risk factors, and 5.9 for  $\geq 3$  risk factors compared to those who scored high on both family atmosphere and religiosity. All of these associations were statistically significant. An evaluation of odds ratios between the other two comparison groups (low family/high religiosity; high family/low religiosity) indicated that a low score on religiosity had a higher impact on the magnitude of the association than a low score on family atmosphere (Table 4).

## 4. Discussion

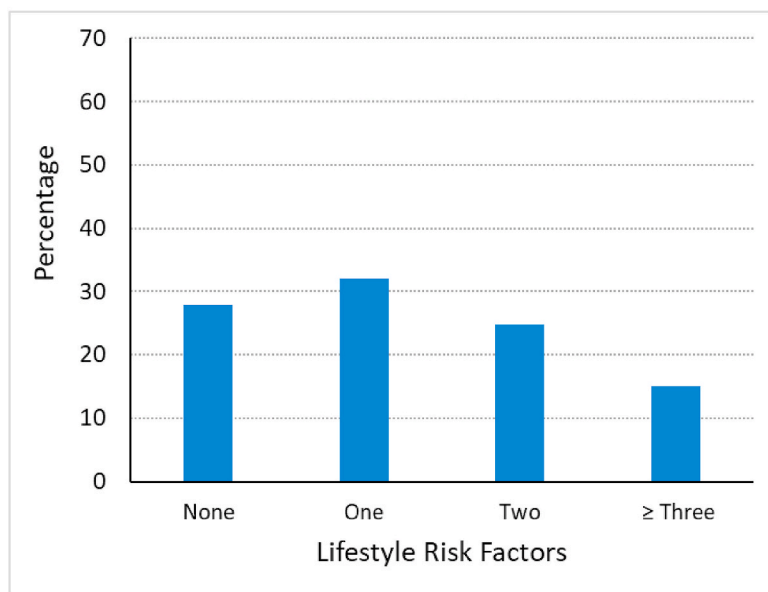
The main findings of this study were 1) a sizeable proportion of Saudi adolescents (15%) reported a risky lifestyle, indicated by having  $\geq 3$  out of 5 assessed risk factors (i.e., obesity, smoking, physical inactivity, unhealthy diet, and excessive screen time), 2) either a low score in self-reported religiosity or family atmosphere was a strong and independent correlate of their lifestyle risk profiles, and 3) having a low score in both religiosity and family atmosphere was associated with a higher lifestyle risk profile when compared to the group that scored high in both religiosity and family atmosphere.

Our study differed from the existing literature in some fundamental ways, so there is no research to which our study could be directly

**A. Prevalence of lifestyle risk factors among Saudi adolescents in Al-Qassim (n= 1752).**



**B. Composite score of lifestyle risk-factor profiles among Saudi adolescents in Al-Qassim (n= 1752).**



**Fig. 1.** A. Prevalence of lifestyle risk factors among Saudi adolescents in Al-Qassim (n = 1752). B. Composite score of lifestyle risk-factor profiles among Saudi adolescents in Al-Qassim (n = 1752).

compared. Most studies reported individual lifestyle factors as the outcome, whereas we created a profile from those factors. Secondly, religiosity and family atmosphere have not been assessed simultaneously in a single study, let alone their combined effect. However, our study findings do not contradict what is currently known. For example, higher religiosity is positively associated with healthy behaviors (e.g., diet and exercise) (Acosta Enriquez et al., 2019; Brown et al., 2001; Wallace & Forman, 1998) and negatively associated with risky behaviors (e.g., smoking and drinking alcohol) (Gäbler et al., 2017; Nagel & Sgoutas-Emch, 2007). Most evidence comes from the Western world

where Christianity is the most common religion. Religiosity in these studies was assessed either as a perception or practices (e.g., church attendance) (Acosta Enriquez et al., 2019; Nagel & Sgoutas-Emch, 2007).

Similarly, a better family atmosphere has been shown to be positively associated with a healthier lifestyle (e.g., exercise) (Shokrvash et al., 2013) and negatively associated with risky behaviors (e.g., smoking and excessive screen time) (Al-Musa, 2019; Yanez et al., 2013) among adolescents. The assessment of family atmosphere varied across studies. In many cases, a surrogate measure, such as family income,

**Table 2**  
Univariate associations between selected covariates and lifestyle risk factors among Saudi adolescents (n = 1752).

|                               | n    | Number of lifestyle risk factors |               |               |                         | p-value |
|-------------------------------|------|----------------------------------|---------------|---------------|-------------------------|---------|
|                               |      | None (n = 489)                   | One (n = 563) | Two (n = 435) | Three or more (n = 265) |         |
| Family atmosphere             |      |                                  |               |               | <0.0001                 |         |
| Below median (low)            | 1011 | 49.1                             | 57.7          | 61.1          | 67.9                    |         |
| Above median (high)           | 741  | 50.9                             | 42.3          | 38.9          | 32.1                    |         |
| Religiosity                   |      |                                  |               |               | <0.0001                 |         |
| Below median (low)            | 886  | 37.2                             | 44.2          | 64.1          | 66.4                    |         |
| Above median (high)           | 866  | 62.8                             | 55.8          | 35.9          | 33.6                    |         |
| Family Atmosphere/Religiosity |      |                                  |               |               | <0.0001                 |         |
| Low family/Low religiosity    | 553  | 19.0                             | 27.9          | 41.1          | 46.8                    |         |
| Low family/High religiosity   | 458  | 30.1                             | 29.8          | 20.0          | 21.1                    |         |
| High family/Low religiosity   | 333  | 18.2                             | 16.3          | 23.0          | 19.6                    |         |
| High family/High religiosity  | 408  | 32.7                             | 25.9          | 15.9          | 12.5                    |         |

P-values were determined with chi-square test.

**Table 3**  
Multi-level multinomial logistic regression model building for lifestyle risk factors among Saudi adolescents (n = 1752).

|                      | Model 1 $X^2$ | Model 2 $X^2$ | Model 3 $X^2$ |
|----------------------|---------------|---------------|---------------|
| School               | 0.1           | 0.2           | 0.8           |
| City                 | 22.0          | 22.3          | 22.0          |
| Socioeconomic status |               | 1.9           | 1.7           |
| Marital status       |               | 3.8           | 3.7           |
| Father's employment  |               | 1.3           | 1.4           |
| Mother's employment  |               | 0.4           | 0.9           |
| Family atmosphere    |               | 25.2          | 20.6          |
| Age                  |               |               | 10.3          |
| Gender               |               |               | 8.9           |
| Religiosity          |               |               | 82.6          |
| Model Fit            |               |               |               |
| -2 Log likelihood    | 483.13        | 2397.43       | 3740.0        |
| Chi-square           | 22.7          | 59.7          | 180.4         |
| Degrees of freedom   | 12            | 27            | 36            |
| p-value              | 0.03          | <0.0001       | <0.0001       |

single-parent household, or family support, was used to describe the family environment (Al Agili & Park, 2012).

The unique finding of the current study was that religiosity and family atmosphere had a combined effect on the adolescent lifestyle profile. The results showed that the likelihood of engaging in risky behaviors was highest when adolescents reported a low family atmosphere and low personal religiosity. Additionally, religiosity had a higher impact on risky lifestyle behavior than family atmosphere had in the context of both factors. This finding is plausible given that religiosity represents an individual's own sense of right and wrong, and this may have a stronger deterrent effect than family atmosphere, which represents a group dynamic over which they have little control.

**Table 4**  
Adjusted associations of covariates with lifestyle risk factors among Saudi adolescents (n = 1752).

| Variables                          | n    | Number of lifestyle risk factors |            |               |            |                         |            |
|------------------------------------|------|----------------------------------|------------|---------------|------------|-------------------------|------------|
|                                    |      | One (n = 563)                    |            | Two (n = 435) |            | Three or more (n = 265) |            |
|                                    |      | OR                               | 95% CI     | OR            | 95% CI     | OR                      | 95% CI     |
| Family atmosphere                  |      |                                  |            |               |            |                         |            |
| Below median                       | 1011 | 1.4                              | 1.08, 1.79 | 1.6           | 1.18, 2.05 | 2.0                     | 1.46, 2.82 |
| Above median (ref)                 | 741  | 1.0                              |            | 1.0           |            | 1.0                     |            |
| Religiosity                        |      |                                  |            |               |            |                         |            |
| Below median                       | 886  | 1.3                              | 0.99, 1.64 | 2.8           | 2.11, 3.65 | 2.9                     | 2.12, 4.04 |
| Above median (ref)                 | 866  | 1.0                              |            | 1.0           |            | 1.0                     |            |
| Family atmosphere/Religiosity      |      |                                  |            |               |            |                         |            |
| Low family/Low religiosity         | 553  | 1.8                              | 1.28, 2.57 | 4.4           | 2.98, 6.44 | 5.9                     | 3.69, 9.48 |
| Low family/High religiosity        | 458  | 1.2                              | 0.90, 1.71 | 1.4           | 0.95, 2.10 | 1.8                     | 1.10, 2.90 |
| High family/Low religiosity        | 333  | 1.1                              | 0.75, 1.57 | 2.4           | 1.63, 3.68 | 2.5                     | 1.48, 4.16 |
| High family/High religiosity (ref) | 408  | 1.0                              |            | 1.0           |            | 1.0                     |            |

\*The following covariates were controlled for in the model: school, city, age, gender, socioeconomic status, parental marital status, and father and mother employment.

### 5. Study limitations

The sampling strategy was based on the structure of the school system in Saudi Arabia (i.e., stratified by gender and level). In order to ensure that schools from each stratum of gender and level were selected from each city, we had to sample an equal number of schools (n = 8) from each city despite the difference in the cities' total number of schools. This may have affected the representativeness of the sample. The data accuracy of a few of the lifestyle factors might be low. Height and weight were self-reported, so it is likely that there is some misclassification in the obesity variable. However, the literature shows that self-reported height and weight have a strong correlation with their measured equivalents (Brener et al., 2003). Physical activity and diet were assessed with single items with which participants evaluated themselves overall as opposed to using a standard scale. We decided to use the single items in order to keep the survey a reasonable length. Although the use of a lifestyle profile gave an overall picture of behaviors among Saudi adolescents, it cannot be determined which lifestyle factor(s) contributed specifically to any particular profile category. Furthermore, using a profile does not allow the reader to know the association of the individual risk factors with religiosity and family atmosphere.

### 6. Conclusion

A significant proportion of Saudi adolescents have risky lifestyles (i.e., 15% have 3 or more lifestyle risk factors). Higher scores in perceived religiosity and family atmosphere were inversely associated with risky lifestyles, indicating that if teenagers are encouraged to nurture a higher sense of religiosity in themselves and are offered a peaceful family environment, they are more likely to adopt a healthy lifestyle.

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involved in the design or methods of the study.

### Ethics approval

The study protocol was reviewed and approved by the research committee at the directorate of the Ministry of Education (MOE) in Qassim, Saudi Arabia. In addition, ethical approval from the Qassim Region Research Ethics Committee (QREC) was taken prior to commencing the study (Ministry of Health, approval number 1440/1513459).

### Data availability

Data will be made available upon reasonable request to the corresponding author.

### CRedit authorship contribution statement

**Tawfik Mamoun Rajab:** Investigation, Data curation, Writing – review & editing. **Juliann Saquib:** Formal analysis, Writing – original draft. **Ahmad Mamoun Rajab:** Conceptualization, Investigation, Data curation, Writing – review & editing. **Saed Enabi:** Conceptualization, Investigation, Data curation, Writing – review & editing. **Saleh Qusai Saleh Ayash:** Investigation, Project administration, Writing – review & editing. **Suhaib Abdelrahman Abdellatif Abdelrahman:** Investigation, Project administration, Writing – review & editing. **Mohammed Abdulaziz Abdulwahab Khojah:** Investigation, Project administration, Writing – review & editing. **Abdulrahman Almazrou:** Writing – review & editing. **Nazmus Saquib:** Conceptualization, Formal analysis, Writing – original draft.

### Declaration of competing interest

None.

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