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ORIGINAL RESEARCH

Behavioral Risk Factors Of Non-Communicable Diseases Among A Nationally Representative Sample Of School-Going Adolescents In Indonesia

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Background: The aim of this study was to investigate the prevalence and correlates of behavioral non-communicable diseases (NCD) risk factors among adolescents in Indonesia.
Methods: Cross-sectional national data were analyzed from 11,124 in-school adolescents (mean age 14.0 years) of the Indonesia Global School-Based Student Health Survey (GSHS) in 2015. Seven behavioral NCD risk factors (substance use, dietary behavior, overweight or obesity, low physical activity, and sedentary behavior) were assessed by questionnaire in a classroom setting.
Results: The prevalence of low physical activity was 87.8%, insufficient fruit and vegetable intake 76.8%, having soft drinks daily 27.9%, leisure-time sedentary behavior 27.3%, overweight or obesity 15.8%, current tobacco use 12.8%, and alcohol use 4.4%. From the seven behavioral NCD risk factors, the mean was 2.5 (SD=1.0), and almost half (46.5%) had at least three risk factors. In adjusted linear regression analysis, being a boy, increasing age and psychological distress increased the odds and hunger or food insecurity and parental support decreased the odds for having behavioral risk factors.
Conclusion: A high co-occurrence of behavioral risk factors was identified. Several risk factors (older age, boys, distress, and poor parental support) were identified that can be targeted in intervention programs.
Keywords: dietary behavior, substance use, physical activity, adolescents, Indonesia

Introduction

Non-communicable diseases (NCDs), such as cardiovascular diseases, cancers, respiratory diseases, and diabetes, cause 71% of all deaths globally, and over 85% in low- and middle-income countries.[1]

Behavioral risk factors, such as tobacco use, physical inactivity, the harmful use of alcohol, and unhealthy diets all increase the risk of dying from a NCD.[1]

In Indonesia, NCD-related mortality accounted for 65% of the deaths in 2010.[2] In addition, Indonesia has a very high burden of tobacco smoking.[2] Changes in the environment, lifestyle, and technology in Indonesia have led to an increase of NCDs.[3] Investigations showed that behavioral risk factors are often acquired during the adolescence period and are then adopted in adulthood.[4,5] There is a paucity of recent national data on behavioral NCD risk variables in the adolescent population in Indonesia.

In a multi-country study (2003–2011) among adolescents, the prevalence of insufficient fruit and vegetable (FV) intake was 74.3%, low physical activity 71.4%,

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alcohol use 15.7%, tobacco use 12.1%, and obesity 7.1%.[6] In the same study,[6] the prevalence of having at least three NCD risk factors (of five risk factors) was 3.8% in the Southeast Asia and 6.4% in Indonesia in 2007.[6] In adolescents in Indonesia, the proportion of current tobacco use was 20.3% in 2014,[7] current alcohol use 2.9% in 2007,[8] insufficient FV intake 75.2% in 2007,[9] physical inactivity (<5 days) 75.6% in 2007,[10] leisure-time sedentary behavior (≥3 hrs/day) was 33.7% in 2007,[10] and overweight or obesity was 7.0%.[11] In a study among adolescents in Brazil, 58.5% reported being exposed to at least two of five behavioral risk factors at the same time,[12] and among adolescents in Nepal, 11.2% had 3–5 risk factors.[13]

As reviewed in Pengpid and Peltzer,[14] factors associated with individual and/or multiple behavioral NCD risk factors among adolescents include male sex, older age, lower socioeconomic status, physical inactivity, insufficient physical activity, not attending physical education classes, overweight/obesity, psychological distress, school truancy, and lack of peer and parental support. The study aimed to investigate the prevalence and correlates of behavioral NCD risk factors in adolescents in Indonesia.

Methods
Sample And Procedure
Cross-sectional national data from the 2015 Indonesia GSHS were analyzed.[15]

> A two-stage cluster sample design was used to produce data representative of all students in Grades 7–12 in Indonesia. At the first stage, schools were selected with probability proportional to enrolment size. At the second stage, classes were randomly selected and all students in selected classes were eligible to participate.[15]

The Ethics Commission for Health Research and Development approved the study and informed consent was obtained from the participating schools, parents, and students.[15]

Measures
The GSHS measure applied to this analysis was used in this survey (Table 1).[16] Inadequate FV consumption was classified as less than five or more servings in a day.[14,17] Overweight and obesity was defined as more than +1 standard deviation (SD) from the median body mass index by age and sex.[18] Inadequate physical activity was defined as not daily at least 60 mins of moderate to vigorous-intensity physical activity.[19] Sedentary behavior was defined as

spending three or more hours per day sitting.[20] The psychological distress items (no close friends, loneliness, anxiety, suicidal ideation, and suicide attempt) were summed and grouped into 0=0, 1=1 single, and 2–5=2 multiple.[14] The four items on parental or guardian support were summed and classified into three groups, 0–1: low, 2: medium, and 3–4: high support."[14]

Data Analysis
Considering the complex design of the study, data analyses were conducted with STATA software version 15.0 (Stata Corporation, College Station, TX, USA). Descriptive statistics are used to provide frequencies, means, and standard deviations. Multivariable logistic and linear regression analyses were utilized for assessing the associations between independent variables and individual and multiple behavioral risk factors. Cases that were missing were excluded from the analyses. P values <0.05% were considered significant.

Results
Sample Description And Proportion Of Behavioral Risk Factors
The sample consisted of 11,124 middle-school students (mean age 14.0 years, Standard Deviation 1.6), 51.1% females and 48.9% males; 4.1% had often experienced hunger, 10.9% had a single psychological distress, and 4.6% had multiple psychological distress. In terms of protective factors, 79.9% of the students attended school in the 30 days, 87.6% had participated in one or more classes of physical education, 39.1% support of their peers, and 52.0% had two to four parental support scores.

Regarding individual behavioral risk factors, 87.8% of the students had low physical activity, 76.8% had insufficient FV intake, 27.9% consumed soft drinks daily, 27.3% engaged in leisure-time sedentary behavior, 15.8% were overweight or obese, and 12.8% and 4.4% were currently using tobacco and alcohol, respectively. The total mean of the measured seven behavioral risk factors was 2.5 (SD=1.0), and the distribution of the multiple occurrence of the behavioral risk factors was 0=1.1%, 1=11.0%, 2=41.4%, 3=32.1%, 4=11.1%, 5=2.8%, 6=0.5, and 7=0.0%, and 46.5% had at least three risk factors (Table 2).

Associations With Individual And Multiple Behavioral Risk Factors
In the adjusted logistic regression model, boys, increasing age, having psychological distress, and participating in

Table 1 Variable Description

Variables	Question	Response Options
Age	How old are you?	11 years old or younger to 16 years old or older
Sex	What is your sex?	Male, Female
Hunger	During the past 30 days, how often did you go hungry because there was not enough food in your home?	1= never to 5= always (coded 1–3=0 and 4–5=1)
	Behavioral risk factors	
Current tobacco use	During the past 30 days, on how many days did you smoke cigarettes/use any tobacco products other than cigarettes, such as sirih, piper betel cerutu, or cigars?	1=0 days to 7=All 30 days (coded 1=0 and 2–7=1)
Current alcohol use	During the past 30 days, on how many days did you have at least one drink containing alcohol?	1 = 0 days to 7 = All 30 days (coded 1=0 and 2–7=1)
Fruits	"During the past 30 days, how many times per day did you usually eat fruit such as pineapples, bananas, oranges, or watermelons?"	"1=I did not eat fruit during the past 30 days to 7=5 or more times per day"
Vegetables	During the past 30 days, how many times per day did you usually eat vegetables, such as carrots, cabbage, spinach, or kangkong/kangkung?	I did not eat vegetables during the past 30 days to 7=5 or more times per day
Height	How tall are you without your shoes on?	… cm
Body weight	How much do you weigh without your shoes on?	… kg
Soft drink consumption	During the past 30 days, how many times per day did you usually drink carbonated soft drinks, such as Coca-Cola, Sprite, Fanta, or Big Bola? (Do not include diet soft drinks.)	1=I did not drink carbonated soft drinks during the past 30 days to 7=5 or more times per day (coded 1=once or more/day)
Physical activity	Physical activity is any activity that increases your heart rate and makes you get out of breath some of the time. Physical activity can be done in sports, playing with friends, or walking to school. Some examples of physical activity are are running, fast walking, biking, dancing, football, menyapu, mengepel, and menyeterika. During the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day?	0=0 days to 7=7 days (coded 0–6=0 and 7=1)
Leisure-time sedentary behavior	How much time do you spend during a typical or usual day sitting and watching television, playing computer games, talking with friends, or doing other sitting activities, such as main play station?	1=Less than 1 hr per day … 3= 3 to 4 hrs per day … 6=8 or more hours a day
	Psychological distress	Yes, No
No close friends	How many close friends do you have?	1 = 0 to 4 = 3 or more (coded 1+=0, 0=1)
Loneliness	During the past 12 months, how often have you felt lonely?	1=never to 5=always (coded 1–3=0 and 4–5=1)
Anxiety	During the past 12 months, how often have you been so worried about something that you could not sleep at night?	1=never to 5=always (coded 1–3=0 and 4–5=1)
Suicide ideation	During the past 12 months, did you ever seriously consider attempting suicide?	Yes, No
Suicide attempt	During the past 12 months, how many times did you actually attempt suicide?	1=0 times to 5=6 or more times (coded 1=0 and 2–5=1)

(*Continued*)

Table 1 (Continued).

Variables	Question	Response Options
	Protective factors	
School attendance	During the past 30 days, on how many days did you miss classes or school without permission?	1=0 days to 5= 10 or more days (coded 1=1 and 2–5=0)
Physical education	During this school year, on how many days did you go to physical education (PE) class each week?	1=0 days to 6=5 or more days (coded 1–4=0 and 5–6=1 two or more days)
Peer support	During the past 30 days, how often were most of the students in your school kind and helpful?	1=never to 5=always (coded 1–3=0 and 4–5=1)
Parental supervision	During the past 30 days, how often did your parents or guardians check to see if your homework was done?	1=never to 5=always (coded 1–3=0 and 4–5=1)
Parental connectedness	During the past 30 days, how often did your parents or guardians understand your problems and worries?	1=never to 5=always (coded 1–3=0 and 4–5=1)
Parental bonding	During the past 30 days, how often did your parents or guardians really know what you were doing with your free time?	1=never to 5=always (coded 1–3=0 and 4–5=1)
Parental respect for privacy	During the past 30 days, how often did your parents or guardians go through your things without your approval?	1=never to 5=always (coded 1–3=0 and 4–5=1)

physical education increased the odds and attending school in the past month and higher parental support decreased the odds of both tobacco and alcohol use. Increasing age and school attendance increased the odds and hunger or food insecurity, participating in classes of physical education, and higher parental support decreased the odds for insufficient FV intake. Younger age, attending school, and parental support increased the odds for overweight or obesity (Table 3).

Being male, younger age and multiple psychological distress increased the odds and attending school decreased the odds for daily soft drink consumption. Participating in physical education, peer and parental support were protective from low physical activity. Increasing age and psychological distress had an association with sedentary behavior during leisure time. Being a boy, increasing age and psychological distress increased the odds and hungey or food insecurity and parental support decreased the odds for multiple behavioral risk factors (Table 4).

Discussion

Results found a significant co-occurrence of NCD behavioral risk factors (mean 2.5 and 46.5% had 3–7 risk factors). This is result is much higher than in a previous

older investigation (3.8% 3–5 risk factors) in Southeast Asia,[6] Indonesia (7.0%),[6] and Nepal (11.2%).[11] The prevalence of physical inactivity (<7 days) (87.8%) in this study was higher than in the older multi-, low-, and middle-income country study (71.4%),[6] similar to Indonesia in 2007 (<5 days) (75.6%).[10] Insufficient FV intake was about the same (76.8% vs 74.3%)[6] and 75.2% in Indonesia in 2007,[9] tobacco use (12.8% vs 12.1%) and lower than in the youth tobacco survey in Indonesia in 2014 (20.3%).[7] Alcohol consumption was lower than in the large multi-country investigation (4.4% vs 15.7%)[6] and higher than in Indonesia in 2007 (2.9%).[8] The proportion of leisure-time sedentary behavior (≥3 hrs/day) was in this study (27.3%) lower than in the 2007 Indonesia GSHS (33.7%).[10] The proportion of overweight or obesity (15.8%) in this study was higher than the Indonesia GSHS in 2007 (7.0%)[11] and in Nepal (6.7%).[13] In the 2012 Indonesia Demographic and Health Survey, 0.8% of the never married females (15–19 years) and 13.9% of the never married males (15–19 years) were current drinkers.[21] The high occurrence of several risk factors, including low physical activity, insufficient FV intake, and tobacco use, and the increase in the co-occurrence of NCD behavioral risk behaviors, and the increase of overweight or obesity

Table 2 Sample Characteristics And Distribution Of Behavioral Risk Factors Of Non-Communicable Diseases

Variable	Sample	Current Tobacco Use	Current Alcohol Use	Inadequate Fruit And Vegetable Consumption	Overweight Or Obesity	Soft Drink Consumption	Inadequate Physical Activity	Leisure-Time Sedentary Behavior	Total Behavioral Risk Factors
	N (%)	%	%	%	%	%	%	%	M (SD)
Sociodemographic									
All	11,124	12.8	4.4	76.8	15.8	27.9	87.8	27.3	2.2 (0.9)
Sex									
Female	6020 (51.1)	2.4	1.6	77.4	15.5	25.3	88.4	27.2	2.1 (0.8)
Male	5090 (48.9)	23.6	7.3	76.2	16.0	30.7	87.1	27.4	2.4 (1.0)
Age									
≤13	4549 (43.6)	9.5	3.4	71.9	18.3	31.7	88.7	20.4	2.1 (0.9)
14	2565 (24.1)	12.5	3.7	76.4	15.2	26.8	87.4	27.6	2.2 (0.9)
15	1943 (14.7)	16.3	4.5	82.7	13.6	25.6	87.4	30.3	2.4 (0.9)
≥16	2067 (17.6)	18.1	7.4	84.3	12.3	22.0	86.4	41.5	2.5 (0.9)
Grade									
7	2740 (25.9)	10.0	4.3	71.3	17.6	32.6	91.5	15.0	2.1 (0.8)
8	2653 (25.9)	12.3	3.6	73.3	15.8	32.1	86.3	24.9	2.1 (0.9)
9	2656 (25.0)	14.6	3.7	77.8	15.2	23.3	86.3	27.6	2.3 (0.9)
10	2032 (23.2)	14.1	6.0	85.4	14.5	19.8	86.8	43.1	2.5 (0.9)
Hunger	482 (4.1)	19.9	6.0	71.6	13.5	33.5	86.4	28.1	2.2 (1.0)
Psychological distress									
0	9117 (84.5)	10.5	2.9	76.9	15.8	27.0	87.9	25.7	2.2 (0.9)
1	1213 (10.9)	18.2	7.2	76.8	16.2	30.8	87.0	32.9	2.4 (1.0)
2–5	492 (4.6)	23.5	13.0	78.9	14.8	32.8	85.6	39.7	2.5 (1.1)
Protective factors School attendance	8660 (79.9)	9.6	3.0	77.2	16.5	26.2	87.8	26.9	2.2 (0.9)
Attending physical education classes/week									
0	1407 (12.4)	15.0	5.1	75.2	14.3	32.1	94.6	20.5	2.2 (0.9)
1	6847 (63.7)	10.4	3.2	78.5	15.8	26.3	87.8	27.6	2.2 (0.9)
≥2	2706 (23.9)	17.9	6.8	73.0	16.2	30.2	84.3	29.8	2.3 (1.0)
Peer support	4282 (39.1)	10.6	3.9	75.6	16.7	25.5	85.3	29.1	2.2 (0.9)
Parental support									
0–1	5173 (48.0)	16.4	5.4	79.2	14.4	29.1	89.8	27.7	2.3 (0.9)
2	3174 (29.6)	10.1	3.5	76.7	15.6	26.7	87.2	28.1	2.2 (0.9)
3–4	2388 (22.4)	7.2	2.3	71.7	19.1	26.6	84.7	25.3	2.1 (0.9)

and alcohol use are cause of concern needing public health interventions for this population in Indonesia.

Consistent with previous findings,[12,13,22,23] this investigation found that male sex, older age, and food security or high economic status increased the likelihood of the co-occurrence of behavioral NCD risk factors in this adolescent population. Unlike findings from some

previous investigations,[23,24] the results of this study found no association between not participating in physical education and multiple health-risk behaviors. The findings of this study showed that having psychological distress increased the odds for having multiple behavioral risk factors as well as several individual risk factors, including alcohol and tobacco use, sedentary

Table 3 Associations With Behavioral NCD Risk Factors (Tobacco, Alcohol, Fruit And Vegetable Consumption, And Overweight Or Obesity)

Variable	Current Tobacco Use	Current Alcohol Use	Inadequate Fruit And Vegetable Consumption	Overweight Or Obesity
	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Sociodemographic				
Sex				
Female	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Male	13.36 (9.09, 19.66)***	4.32 (2.80, 6.67)***	(0.94 0.86, 1.02)	1.12 (0.97, 1.29)
Age				
≤13	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
14	1.46 (1.15, 1.85)**	1.16 (0.82, 1.64)	1.27 (1.14, 1.42)***	0.80 (0.68, 0.94)**
15	2.08 (1.53, 2.82)***	1.49 (0.99, 2.23)	1.83 (1.50, 2.23)***	0.72 (0.55, 0.95)*
≥16	2.51 (1.64, 3.85)***	2.74 (1.60, 4.67)***	2.03 (1.61, 2.55)***	0.63 (0.42, 0.95)*
Hunger	1.17 (0.84, 1.63)	0.83 (0.47, 1.44)	0.73 (0.58, 0.91)**	0.87 (0.62, 1.23)
Psychological distress				
0	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
1	2.02 (1.61, 2.54)***	2.40 (1.67, 3.46)***	0.97 (0.79, 1.18)	1.14 (0.94, 1.38)
2–5	2.55 (1.73, 3.77)***	4.21 (2.77, 6.42)***	1.14 (0.84, 1.55)	0.99 (0.74, 1.32)
Protective factors				
School attendance	0.45 (0.38, 0.54)***	0.44 (0.33, 0.57)***	1.18 (1.05, 1.32)**	1.33 (1.07, 1.65)**
Attending physical education classes/≥2 week	1.45 (1.15, 1.83)**	1.63 (1.20, 2.22)**	0.79 (0.70, 0.90)***	1.03 (0.86, 1.23)
Peer support	0.99 (0.81, 1.22)	1.07 (0.80, 1.43)	0.92 (0.81, 1.04)	1.10 (0.96, 1.25)
Parental support				
0–1	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
2	0.72 (0.61, 0.86)***	0.76 (0.56, 1.04)	0.87 (0.77, 0.99)*	1.07 (0.88, 1.29)
3–4	0.52 (0.40, 0.69)***	0.58 (0.39, 0.84)**	0.70 (0.61, 0.79)***	1.32 (1.11, 1.57)**

Notes: ***P<0.001, **P<0.01, *P<0.05.
Abbreviations: AOR, adjusted odds ratio; CI, confidence interval.

behavior, and consumption of soft drinks daily. It is possible that a "reciprocal relationship exists between mood and the engagement in mood-regulating behaviors (i.e., substance use and sedentary behavior)."[25] This investigation found that school attendance and higher parental support were protective from multiple behavioral NCD risk factors, which is consistent with the findings of previous studies.[26–28] Interventions to reduce multiple behavioral NCD risk factors may want to reinforce attending school and promoting parental support among adolescents.

Consistent with previous studies,[13,23] male sex and older age were associated with alcohol and tobacco. In this investigation, participating in physical education was found to be associated with tobacco and alcohol use, while in a previous study,[23] being inactive while

participating in physical education was associated with tobacco use.[23] In agreement with previous studies,[23,24,29] this study found that attendance of physical education was protective from low physical activity and inadequate FV intake. Attendance of school was found protective from daily consumption of soft drinks and insufficient FV intake. This finding supports the importance of physical education and other school activities in promoting healthy behaviors. Parental support was protective from several behavioral NCD risk factors, including alcohol and tobacco use, low physical activity, and insufficient FV intake. However, both attendance of school and receiving high support from parents were positively associated with overweight or obesity. Nevertheless, parental support can be utilized in programs preventing substance use and improving dietary behavior and physical activity.

Table 4 Associations With Behavioral NCD Risk Factors (Physical Inactivity, Leisure-Time Sedentary Behavior, And Total Number Of Behavioral NCD Risk Factors)

Variable	Soft Drink Consumption	Inadequate Physical Activity	Leisure-Time Sedentary Behavior	Total Behavioral Risk Factors
	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	Adjusted Beta (95% CI)
Sociodemographics				
Sex				
Female	1 (Reference)	1 (Reference)	1 (Reference)	Reference
Male	1.27 (1.12, 1.44)***	0.85 (0.72, 1.01)	0.97 (0.85, 1.10)	0.21 (0.15 to 0.27)***
Age				
≤13	1 (Reference)	1 (Reference)	1 (Reference)	Reference
14	0.78 (0.67, 0.90)***	0.89 (0.68, 1.16)	1.44 (1.23, 1.69)***	0.11 (0.06 to 0.16)***
15	0.74 (0.62, 0.89)***	0.94 (0.73, 1.20)	1.74 (1.27, 2.38)***	0.25 (0.15 to 0.35)***
≥16	0.61 (0.48, 0.80)***	0.80 (0.59, 1.10)	2.79 (1.98, 3.93)***	0.38 (0.25 to 0.50)***
Hunger	1.25 (1.00, 1.57)	0.87 (0.64, 1.19)	0.93 (0.94, 1.17)	−0.12 (−0.23 to −0.02)*
Psychological distress				
0	1 (Reference)	1 (Reference)	1 (Reference)	Reference
1	1.17 (1.00, 1.38)	0.89 (0.74, 1.08)	1.43 (1.22, 1.68)***	0.17 (0.09 to 0.24)***
2–5	1.30 (1.03, 1.65)*	0.79 (0.58, 1.07)	1.82 (1.45, 2.28)***	0.26 (0.15 to 0.38)***
Protective factors				
School attendance	0.70 (0.62, 0.79)***	0.98 (0.82, 1.18)	1.06 (0.94, 1.19)	−0.05 (−0.10 to −0.07)***
Attending physical education classes/ ≥2 week	1.08 (0.93, 1.27)	0.69 (0.53, 0.89)**	1.17 (1.00, 1.36)	0.001 (−0.0.06 to 0.07)
Peer support	0.91 (0.81, 1.02)	0.75 (0.63, 0.89)***	1.12 (1.00, 1.26)	−0.006 (−0.05 to 0.04)
Parental support				
0–1	1 (Reference)	1 (Reference)	1 (Reference)	Reference
2	0.94 (0.83, 1.08)	0.79 (0.64, 0.97)*	1.05 (0.93, 1.19)	−0.07 (−0.12 to −0.02)**
3–4	0.95 (0.83, 1.08)	0.67 (0.55, 0.81)***	0.93 (0.81, 1.07)	−0.14 (−0.20 to −0.08)***

Notes: ***P<0.001, **P<0.01, *P<0.05.
Abbreviations: AOR, adjusted odds ratio; CI, confidence interval.

Disclosure

The authors report no conflicts of interest in this work.

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