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Evaluating Knowledge Attitude and Practice Regarding Healthy Lifestyle among Overweight and Obese Adolescents in Gombak

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Abstract

Background: Adolescent obesity is a significant public health threat in Malaysia, with one in three adolescents classified as overweight or obese. However, there is limited research examining the knowledge, attitudes, and practices (KAP) related to healthy lifestyles among target population. This study aims to provide a baseline understanding of their knowledge gaps and to explore the relationship between sociodemographic characteristics and KAP scores.

Methods: This cross-sectional study was conducted among 400 adolescents aged 15-16 years from selected schools in Gombak District, Malaysia. Eligible participants were identified as overweight or obese according to WHO BMI-for-age standards during the 2024 SEGAK school health screening, and all who met the criteria were invited to participate. Data were collected using the validated Knowledge, Attitude, and Practice on Healthy Lifestyle Questionnaire (KAP-HLQ), which comprises domains on knowledge, attitudes, and practices related to nutrition, physical activity, and lifestyle behaviours. Internal reliability was confirmed in the present study (knowledge $\alpha = 0.76$; attitude $\alpha = 0.74$; practice $\alpha = 0.63$). Ethical approval was obtained from the University of Malaya Research Ethics Committee, and informed parental consent and adolescent assent were secured. Data were analysed in JASP version 0.95.0.0 using descriptive, bivariate, and multivariable statistics, with correlations and partial correlations assessing interrelationships among KAP domains.

Results: Mean scores indicated moderate knowledge (21.34 ± 5.77/42), positive attitudes (79.45 ± 6.16/135), and moderate practices (90.38 ± 9.16/140). Knowledge was significantly associated with practice (partial $r = 0.24$, $p = .002$), but attitudes were not correlated with practice ($r = 0.09$, $p = .210$). Regression analyses showed maternal education ($\beta = 0.21$, $p < .001$) and household income ($\beta = 0.14$, $p = .004$) predicted knowledge, while ethnicity ($\beta = 0.19$, $p = .021$) predicted attitudes. Practices were predicted by maternal education ($\beta = 0.14$, $p = .023$) and household income ($\beta = 0.12$, $p = .018$). Models explained 5–15% of variance.

Conclusion: Overweight and obese adolescents in Gombak demonstrated moderate knowledge and practices but generally positive attitudes, with maternal education, income, and ethnicity as key predictors. The knowledge–practice link was significant, but attitudes did not translate into behaviours, challenging the linear KAP model. Interventions should integrate socioeconomic and cultural determinants, strengthen family and school supports, and address structural barriers to bridge the

knowledge–practice gap.

Keywords: Knowledge, Attitude, Practice, Healthy Lifestyle, Overweight, Obesity, Malaysian Adolescents.

List of Abbreviations

BMI: Body Mass Index, EPaL: Eat Right, Be Positive About Your Body and Live Actively, GBD: Global Burden of Diseases, HLQ: Healthy Lifestyle Questionnaire, IPH: Institute for Public Health, KAP: Knowledge-Attitude-Practice, MOE: Ministry Of Education, NCDs: Non-Communicable Diseases, NHMS: National Health and Morbidity Survey, NPPM: National Nutrition Policy of Malaysia, SD: Standard Deviation, STROBE: Strengthening the Reporting of Observational Studies in Epidemiology, UM: University of Malaya, UMREC: University of Malaya Research Ethics Committee, WHO: World Health Organization

Introduction

Childhood and adolescent obesity is a global public health challenge that has increased significantly both in developed and developing countries during the last decades [1]. The World Health Organization (WHO) recently reported that the number of overweight and obese children and adolescents aged 5-19 years has multiplied four times between the years 1975 and 2016 [2]. In addition, adolescent obesity is also of concern because it significantly contributes to high mortality as well as morbidity from Non-Communicable Diseases (NCDs) in adulthood [3,4]. This emergence has effects beyond the health outcomes; it is an economic burden on communities with direct costs as a result of absorbing the increased cost of healthcare and loss of productivity [5,6].

In Malaysia, the prevalence of obesity among adolescents has become alarming. The National Health and Morbidity Survey (NHMS) reported that in Year 2022, approximately 33.2% among age group of adolescents (13-19) were overweight or obese, which is six times higher than the 2006 level 5.4% [7-9]. This alarming escalation in childhood obesity, despite various government-driven policies such as the Healthy School Canteen Guidelines and canteens' requirements for healthy food (2012) and The National Nutrition Policy of Malaysia (NPPM) (2003), suggests a wide discrepancy between existing interventions and a breakthrough solution [10]. The adolescent age group is considered a critical phase of development, where children transition into adults and start establishing habits that will influence a healthy lifestyle, including nutrition behaviour, physical activity and duration of sleeping [11]. The consequences related to adolescent obesity are not restricted to health concerns but also extend to psychological and social issues such as stigmatisation, low self-esteem and difficulties in academic performance [12]. Although the causes of this multi-complex problem can be genetically or biochemically based, they also include multiple social, behavioural or environmental determinants [13-15].

Obesity is a complex health problem that requires a multifaceted approach and preventive strategies. The Knowledge, Attitude and Practice (KAP) model provides a useful framework for understanding adolescent obesity, as it assumes that knowledge and attitudes act as precursors to behavioural change. The model suggests a linear sequence in which awareness of a health issue can lead to attitudinal change and, over time, to healthier practices [16, 17] However, evidence consistently points to a "translation gap," where improved knowledge does not always translate into better behaviours [18, 19]. This gap is often shaped by contextual influences, including sociodemographic factors, parental roles, and environmental constraints [20-22]. In Malaysia, school-based KAP studies such as the Eat Right, Be Positive About Your Body and Live Actively (EPaL) trial have shown significant improvements in knowledge but mixed results for attitudes and practices, underscoring the importance of exploring mediating factors [23]. Sociodemographic characteristics such as sex, age, ethnicity, parental education, household income, and locality are well-established predictors of both KAP outcomes and weight status (Kang et al., 2024). Incorporating these predictors

into the KAP framework allows for a clearer understanding of how knowledge, attitudes, and practices interact with upstream social determinants to influence adolescent obesity (Figure 1.1).

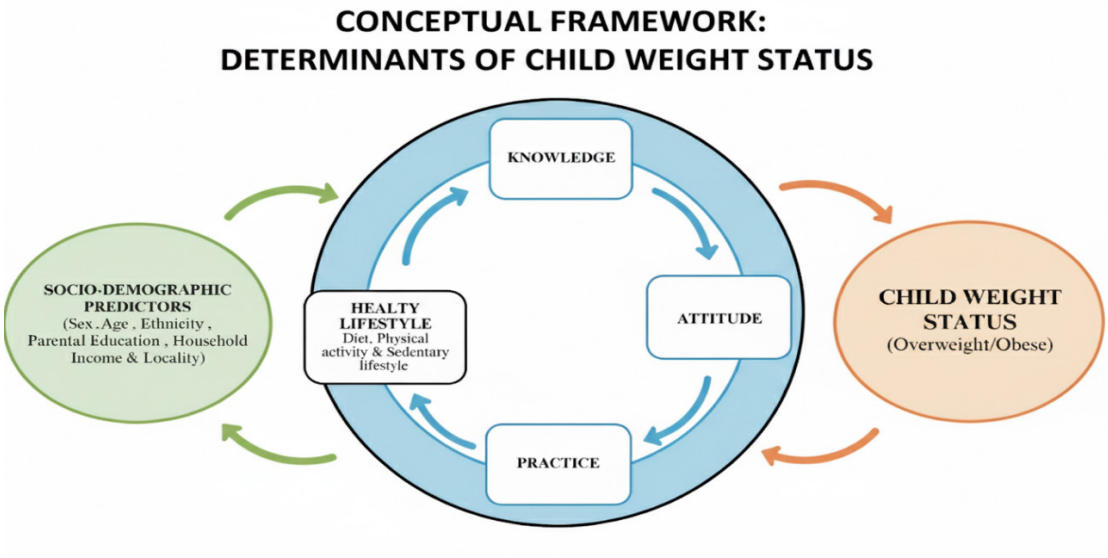

Figure 1: Conceptual Framework of Child Weight Status

Against this backdrop, the present study was designed to assess knowledge, attitudes, and practices related to a healthy lifestyle among overweight and obese adolescents in Gombak District, Selangor. Gombak was selected as the study site because it represents a mixed urban-rural district with considerable ethnic diversity, reflecting Malaysia's broader demographic profile. This makes it a suitable setting to examine how sociodemographic predictors, including income, education, and cultural background, shape adolescent health behaviours. By applying a theoretically grounded KAP continuum and focusing on high-risk population, this study aims to generate evidence to highlight areas for behaviour change, equitable and culturally responsive adolescent obesity prevention strategies in Malaysian school settings.

Methodology

Study Setting and Design

The current study was a cross-sectional survey conducted among overweight and obese 15-16-year-olds in Gombak, Selangor, Malaysia, which has both urban and rural populations, to provide an appropriate context for adolescent health research. There is a District Health Office-supported school health programme for uniform screening and authentic adolescent health data. As the main author is based at the Gombak District Health Office's School Health Team, this research has the potential to benefit some practised activities, current close relationships with schools and teachers, and participant accessibility and data collection. This representativeness, as well as a clear health infrastructure and work experience, gives construct validity on the feasibility of implementing research in this particular district.

The main goal was to assess knowledge, attitudes and practices (KAP) of the respondents towards healthy lifestyles with a focus on the Knowledge, Attitudes and Practices on Healthy Lifestyle Questionnaire (KAP-HLQ). The study adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (Von Elm E et al., 2008). The STROBE checklist is provided as Appendix 11 for transparency and quality.

The survey procedure involved two stages. Phase 1 was based on SEGAK data from the Gombak District Health Office school health screening programme conducted in 2024, categorizing adolescents using WHO BMI-for-age growth reference. Phase 2 was through selection by clusters of the school with large groups of target population and invited in survey.

Sampling Strategy

The two-stage cluster sampling method was used, similar to that of N. [7]. In the first phase, secondary schools in Gombak were selected by random sampling from the list of 212 secondary schools provided by the Selangor State Education Department. In the second stage, all 15-16-year-old adolescents from selected schools who were prospectively identified as overweight or obese in the 2024 screening were invited to participate, with invitations sent from schools with a higher density of the eligible population. This ensured inclusivity and reduced the potential for sampling bias compared to selecting a sub-sample.

n = (N * z^2 * p * q) / (E^2 * (N - 1) + z^2 * p * q), where n = required sample size, E = margin of error (0.05), z = standard normal deviate (designated as 1.96 which corresponds to a confidence level of 95%), N = population size(2772), P =proportion of respondents against expressing any opinion about the specific characteristic estimated to be not more than 50 [24]. As such, the minimum and estimated sample size for the study would be 340 overweight and obese students from a total population of 2772 overweight and obese children. This methodology guaranteed an adequate sample size to detect significant differences in KAP scores and determinants.

Study Population

Study populations were adolescents between 15 and 16 years who were overweight/obese using the WHO BMI-for-age field reference standard. The latter cut-offs were taken into account to categorise overweight and obesity, respectively, when BMI--for-age values > +1 and > +2 SD. All adolescents aged 15-16 years classified as overweight or obese by WHO BMI-for-age standards in the 2024 SEGAK school health screening and enrolled in the selected schools were invited to participate. This inclusive approach minimised sampling bias by avoiding sub-sampling.

Inclusion criteria are adolescents aged 15-16 years, overweight or obese status, studying at selected schools in Gombak district, able to communicate in Bahasa Malaysia or English, and able to provide informed assent (informed consent for participants <18 years old, with their parents' consent). Exclusion criteria are youth with a chronic medical condition or other physical or cognitive impairment that could affect participation; those currently enrolled in a formal weight-control program; those who lack English-speaking proficiency; and those who are unable to provide independent, informed assent or decline to participate.

These criteria are comparable with the "Eat Right, Be Positive about Your Body and Live Actively" (EPaL) intervention trial in Malaysia, which also targeted overweight/obese adolescents [23]. These earlier findings, for example, by CC et al. (2015), who stressed the high prevalence of obesity and disordered eating among Malaysian adolescents, lend further credence to the need for researchers to examine adolescents' reappraisals.

Study Tools

The primary instrument used was the Knowledge, Attitude, and Practice on Healthy Lifestyle Questionnaire (KAP-HLQ), which was previously validated in a Malaysian context [25]. The questionnaire comprised three sections:

Knowledge: 42 multiple-choice questions about healthy eating, growth and physical activity offered in multiple-choice form. The score ranged from 0 to 42, with 1 point per correct answer.

Attitude: 27 items scored on a 5-point Likert scale rated from 1 (never) to 5 (always), categorised under four domains: dietary and physical activity/ role represent (role of diet /physical activity); lifestyle/ growth and development; ability to comply with recommendations. Scores ranged from 27 to 135, with higher scores indicating a more positive attitude.

Practice: 28 items on dietary and activity practices (5-point frequency scale; 1 = never -5 = very often). The instrument was con-

structed based on six domains: meal pattern, food group intake, energy-dense food consumption, planned menu time, physical activity, and sedentary behaviour (resulting in a total score of 28-140).

The KAP-HLQ was originally validated in Malaysia by CC et al. (2015), who established its construct validity and internal consistency. In the present study, descriptive statistics were employed to describe the data and Cronbach's alpha was used to re-examine internal reliability. The knowledge ($\alpha = 0.76$) and attitude ($\alpha = 0.74$) domains demonstrated acceptable internal consistency, while the practice domain showed moderate reliability ($\alpha = 0.63$).

Ethical Review and Data Collection

The research was approved by the University of Malaya Research Ethics Committee (UMREC) (ID: UM. TNC (P&I)/UMREC_4871). Written consent was obtained from the Ministry of Education, the Selangor State Education Department, and the Gombak District Education Office prior to data collection. The aims and procedures of the study were explained to school administrators. Parental/guardian consent and adolescent assent were obtained for participants under 18 years of age. Participation was voluntary, with the option to withdraw at any time without repercussion.

Because adolescent obesity is a sensitive subject, several measures were implemented to minimise stigma and safeguard participants' dignity:

Invitations were sent privately through class teachers to avoid public labelling.

Each participant's survey responses were de-identified and coded to ensure confidentiality.

Non-participation or withdrawal carried no penalty.

Data were reported in aggregate form; no schools or individuals were identifiable.

These safeguards were implemented to ensure that participants experienced no harm, discrimination, or embarrassment. The ethical approach was consistent with the principles of human research set forth in the Declaration of Helsinki. Respondents completed a questionnaire that included sociodemographic information (gender, age, and ethnicity) and the KAP-HLQ.

Data Analysis

Data were analysed using JASP version 0.95.0.0. The analysis plan was guided by the study's conceptual framework, which considered sociodemographic characteristics as predictors of KAP domains and the interrelationships among knowledge, attitudes, and practices.

Descriptive statistics were used to summarise participants' sociodemographic characteristics and KAP scores. Continuous variables were expressed as means and standard deviations, while categorical variables were presented as frequencies and percentages.

The Kolmogorov–Smirnov test was used to assess the normality of continuous variables, and statistical tests were selected accordingly.

For bivariate analyses, independent t-tests compared KAP scores between two groups (e.g., sex, age group, locality, mother's work status, mother's marital status). For predictors with more than two categories (e.g., ethnicity, household income, parental education), one-way ANOVA was performed. Significant results were followed by Bonferroni post hoc tests. Effect sizes were reported as Cohen's d for t-tests and eta squared (η^2) for ANOVAs. Non-parametric alternatives (Mann–Whitney U and

Kruskal–Wallis) were used when normality assumptions were not met.

To examine interrelationships among KAP domains, correlations were assessed using Pearson's or Spearman's correlation coefficients, depending on data distribution. Partial correlations were also conducted to adjust for key confounders (maternal education and household income), allowing evaluation of whether knowledge, attitudes, and practices remained significantly associated after controlling for socioeconomic influences.

To identify independent predictors of KAP outcomes, multiple linear regression analyses were performed. Standardised beta (β) coefficients, p-values, and adjusted R^2 were reported to indicate the predictive strength and variance explained. Regression analyses also examined whether sociodemographic factors explained variation in KAP scores beyond the interrelationships among the KAP domains. The significance level for all analyses was set at $p < 0.05$. Sensitivity or subgroup analyses (e.g., stratification by sex or household income) were considered but not performed due to sample size constraints.

Results

Sociodemographic Characteristics of Respondents.

A total of 400 overweight and obese adolescents participated in this study. The sample was predominantly female (55.7%), with the age distribution nearly equal between 15- and 16-year-olds. Ethnically, most participants were Malay (70%), followed by Indian (16.7%) and Chinese (13.3%). The majority of respondents (77.8%) resided in rural areas, and almost half (47.3%) came from middle-income households. In terms of parental education, most mothers had secondary or tertiary education, and over half (60.8%) were employed. The majority of fathers also had secondary or tertiary education. The marital status of mothers was predominantly married (89.5%). These findings are summarized in Table 3.1.

Table1: Sociodemographic Characteristics of Respondents (N = 400).

Variable	Category	N	%
Sex	Male	177	44.3
	Female	223	55.7
Age	15 years	197	49.3
	16 years	203	50.7
Ethnicity	Malay	280	70
	Chinese	53	13.3
	Indian	67	16.7
Household Income	Low (B40)	105	26.3
	Middle (M40)	189	47.3
	High (T20)	106	26.5
Mother's Education	Primary	66	16.5
	Secondary	184	46
	Tertiary	150	37.5
Father's Education	Primary	65	16.3
	Secondary	179	44.8
	Tertiary	156	39

Locality	Urban	89	22.3
	Rural	311	77.8
Mother's Working Status	Working	243	60.8
	Not working	157	39.3
Mother's Marital Status	Married	358	89.5
	Other	42	10.5

*Note. Percentages may not total 100% due to rounding

Knowledge of Healthy Lifestyle

Cronbach's alpha coefficients showed that the knowledge (α = 0.76) and attitude (α = 0.74) domains had acceptable internal consistency, while the practice domain had moderate reliability (α = 0.63), indicating the reliability of the KAP-HLQ questionnaire for this adolescent sample.

The average knowledge score was moderately high, with participants scoring around 21 out of 42 (M=21.34; SD=5.77), indicating a general understanding of healthy lifestyles. The attitude score was also positive, averaging 79 out of 135 (M=79.45; SD=6.16), suggesting generally favourable views on healthy living. In terms of practices, the average score of 90 out of 140 (M=90.38; SD=9.16), revealed that participants engaged moderately in healthy lifestyle behaviours. These findings are illustrated in Figure 3.1.

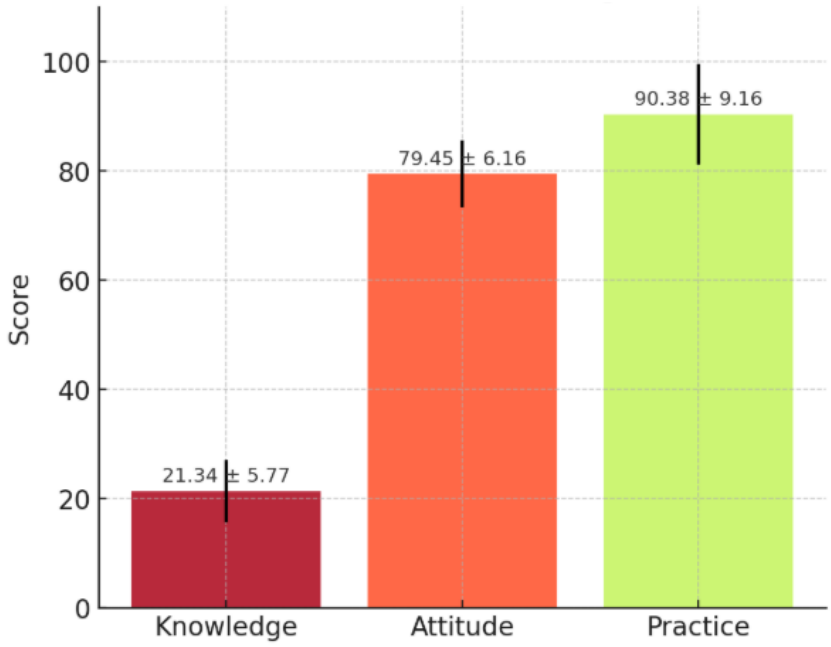

Figure 2: Mean (±SD) Scores for Knowledge, Attitude, and Practices.

Statistical analysis using independent t-tests showed no significant differences in knowledge by sex, age, or locality, with small effect sizes. However, a higher level of knowledge was found among adolescents with working mothers ($t(398) = 2.42$, $p = .016$, Cohen's $d = 0.40$) and those whose mothers were married ($t(398) = 2.09$, $p = .037$, Cohen's $d = 0.21$), indicating moderate and small effect sizes, respectively. These findings are presented in Table 3.2.

Table 2: Independent t-tests for Knowledge Scores by Sociodemographic Factors (N=400).

Variable	Group	Knowledge Score (M ± SD)	t(df)	p-value	Cohen's d
Sex	Male	21.09 ± 6.24	-1.93(398)	0.054	–0.19
	Female	21.53 ± 5.37			
Age	15 years	20.77 ± 5.84	–0.87(398)	0.384	–0.11
	16 years	21.88 ± 5.66			
Locality	Urban	20.87 ± 6.18	0.76(398)	0.45	0.08
	Rural	21.47 ± 5.65			
Mother's Work Status	Working	21.51 ± 5.77	2.42(398)	0.016*	0.4
	Not working	21.06 ± 5.76			
Mother's Marital Status	Married	21.57 ± 5.60	2.09(398)	0.037*	–0.21
	Other	19.31 ± 6.74			

*Note: Independent t-tests were used. $p < 0.05$ indicates significance.

*Cohen's d effect sizes: 0.20 = small, 0.50 = medium, 0.80 = large.

Furthermore, One-way ANOVA results revealed that ethnicity, household income, and maternal education significantly influenced knowledge scores. Indian adolescents scored lower compared to their Malay and Chinese peers, with significant ethnic differences. Adolescents from higher-income households, $F(2, 397) = 12.02$, $p < 0.001$, $\eta^2 = 0.06$ and those with mothers who had a tertiary education also demonstrated higher knowledge scores, $F(2, 397) = 14.07$, $p < 0.001$, $\eta^2 = 0.07$. In contrast, father's education was not significantly associated with knowledge scores.

Table 3: One-way ANOVA of Knowledge Scores by Ethnicity, Household Income, Maternal Education and Father's Education.

Variable	Group	Knowledge Score (Mean ± SD)	F (df)	p-value	η2
Ethnicity	Malay	22.26 ± 5.36	20.74 (2,397)	<0.001	0.1
	Chinese	21.34 ± 5.93	8.59 (2,397)	<0.001	0.04
	Indian	17.45 ± 5.72	2.79 (2,397)	0.063	ns
Household Income	Low	19.10 ± 6.16	12.02 (2,397)	<0.001	0.06
	Middle	21.85 ± 5.38	1.57 (2,397)	0.21	ns
	High	22.64 ± 5.46	3.21 (2,397)	0.042	0.02
Mother's Education	Primary	18.62 ± 5.97	14.07 (2,397)	<0.001	0.07
	Secondary	21.02 ± 5.84	0.40 (2,397)	0.668	ns
	Tertiary	22.91 ± 5.06	3.80 (2,397)	0.023	0.02
Father's Education	Primary	20.32 ± 6.06	8.21 (2,397)	<0.001	0.04
	Secondary	20.45 ± 6.05	0.89 (2,397)	0.412	ns
	Tertiary	22.77 ± 4.99	0.41 (2,397)	0.665	ns

*Note. One-way ANOVA used. $p < 0.05$ considered significant. ns = not significant.

*Post-hoc Bonferroni comparisons indicated that Malay and Chinese adolescents had significantly higher knowledge scores than Indian adolescents. Adolescents from high-income and tertiary-educated maternal backgrounds had higher scores than their counterparts.

Attitudes toward Healthy Lifestyle

The mean attitude score of 79.45 (SD = 6.16) indicated generally positive attitudes toward healthy lifestyle behaviours. When comparing subgroups, independent t-tests revealed no significant differences based on sex, age, or locality. However, One-way ANOVA showed significant differences by ethnicity, with Indian adolescents reporting more positive attitudes than Malay and Chinese adolescents, reflecting a small yet meaningful effect $F(2, 397) = 8.12$, $p < 0.001$, $\eta^2 = 0.04$.

Unlike knowledge, there were no significant differences in attitudes based on household income, maternal education, or father's education. These observations are detailed in Table 3.4 and Table 3.5.

Table 4: Independent t-tests for Attitude Scores by Sociodemographic Factors (N = 400).

Variable	Group	Attitude Score (M ± SD)	t(df)	p-value	Cohen's d
Sex	Male	78.73 ± 6.26	–0.85(398)	0.397	0.09
	Female	80.02 ± 6.02			
Age	15 years	79.83 ± 5.98	–0.72(398)	0.471	0.07
	16 years	79.08 ± 6.32			
Locality	Urban	79.29 ± 6.46	1.02(398)	0.308	0.1
	Rural	79.49 ± 6.07			
Mother's Work Status	Working	79.55 ± 6.03	0.42(398)	0.675	0.04
	Not working	79.29 ± 6.36			
Mother's Marital Status	Married	79.33 ± 6.28	–0.59(398)	0.554	–0.06
	Other	80.45 ± 4.86			

Note. Independent t-tests were used. $p < .05$ considered significant.

Practices Related to Healthy Living

Participants demonstrated moderate engagement in healthy practices, with a mean score of 90.38 (SD = 9.16). Independent t-tests revealed that adolescents with working mothers scored higher on practice measures ($t(398) = 2.21$, $p = .027$, Cohen's $d = 0.28$) compared to those with non-working mothers, and those with married mothers also scored slightly better than their peers from unmarried households. These results have been presented in Table 3.6.

One-way ANOVAs (Table 3.7) showed no significant differences in practice scores by ethnicity, household income, maternal education, or father's education, indicating that these broader sociodemographic factors were not major determinants of prac-

tice in this sample.

These findings suggest that maternal factors, particularly work status and marital stability, may play a greater role in shaping adolescents' healthy lifestyle behaviours than general demographic or socioeconomic factors.

Table 5: One-way ANOVA of Attitude Scores by Ethnicity, Household Income, Maternal Education and Father's Education.

Variable	Group	Attitude Score (Mean ± SD)	F (df)	p-value	η2
Ethnicity	Malay	78.76 ± 5.77	20.74 (2,397)	<0.001	0.1
	Chinese	79.62 ± 6.71	8.59 (2,397)	<0.001	0.04
	Indian	82.16 ± 6.58	2.79 (2,397)	0.063	ns
Household Income	Low	80.24 ± 6.05	12.02 (2,397)	<0.001	0.06
	Middle	79.40 ± 6.28	1.57 (2,397)	0.21	ns
	High	78.75 ± 6.00	3.21 (2,397)	0.042	0.02
Mother's Education	Primary	78.94 ± 6.16	14.07 (2,397)	<0.001	0.07
	Secondary	79.71 ± 6.57	0.40 (2,397)	0.668	ns
	Tertiary	79.35 ± 5.63	3.80 (2,397)	0.023	0.02
Father's Education	Primary	80.11 ± 6.78	8.21 (2,397)	<0.001	0.04
	Secondary	79.61 ± 6.14	0.89 (2,397)	0.412	ns
	Tertiary	78.98 ± 5.90	0.41 (2,397)	0.665	ns

*Note. One-way ANOVA used. $p < 0.05$ considered significant. ns = not significant.

* Post-hoc Bonferroni comparisons indicated that Indian adolescents had significantly higher attitude scores compared to Malay and Chinese adolescents.

Table 6: Independent t-tests for Practice Scores by Sociodemographic Factors (N=400).

Variable	Group	Practice Score (Mean ± SD)	t- (df)	p-value	Cohen's d
Sex	Male	91.23 ± 9.25	–1.11(398)	0.267	0.11
	Female	89.70 ± 9.06			
Age	15 years	90.38 ± 9.10	–0.92(398)	0.357	0.09
	16 years	90.38 ± 9.24			
Locality	Urban	90.55 ± 9.35	0.74(398)	0.461	0.07
	Rural	90.33 ± 9.12			
Mother's Work Status	Working	90.51 ± 8.74	2.21(398)	0.027*	0.28
	Not working	90.17 ± 9.80			
Mother's Marital Status	Married	90.51 ± 9.12	2.00(398)	0.046*	0.23
	Other	88.67 ± 9.75			

Note. Independent t-tests were used. $p < .05$ considered significant. Cohen's d effect sizes: 0.20 = small, 0.50 = medium, 0.80 = large.

Table 7: One-way ANOVA of Attitude Scores by Ethnicity, Household Income, Maternal Education and Father's Education.

Variable	Group	Practice Score (Mean ± SD)	F (df)	p-value	η2
Ethnicity	Malay	89.78 ± 9.16	20.74 (2,397)	<0.001	0.1
	Chinese	92.92 ± 9.99	8.59 (2,397)	<0.001	0.04
	Indian	90.90 ± 8.18	2.79 (2,397)	0.063	ns
Household Income	Low	90.00 ± 8.96	12.02 (2,397)	<0.001	0.06
	Middle	89.53 ± 9.16	1.57 (2,397)	0.21	ns
	High	92.27 ± 9.17	3.21 (2,397)	0.042	0.02
Mother's Education	Primary	88.70 ± 8.27	14.07 (2,397)	<0.001	0.07
	Secondary	89.72 ± 8.88	0.40 (2,397)	0.668	ns
	Tertiary	91.93 ± 9.69	3.80 (2,397)	0.023	0.02
Father's Education	Primary	89.98 ± 10.31	8.21 (2,397)	<0.001	0.04
	Secondary	90.07 ± 8.89	0.89 (2,397)	0.412	ns
	Tertiary	90.90 ± 9.00	0.41 (2,397)	0.665	ns

*Note. One-way ANOVA used. $p < .05$ considered significant. η^2 reported as effect size.

Table 8: Multiple Linear Regression Predicting Knowledge, Attitudes, and Practices from Sociodemographic Factors.

Predictor	Knowledge β (p)	Attitude β (p)	Practice β (p)
Age (15 vs 16)	–0.03 (0.787)	–0.03 (0.787)	0.02 (0.842)
Sex (Male vs Female)	0.05 (0.300)	0.12 (0.224)	0.00 (0.999)
Ethnicity (Indian vs Malay)	–0.25 (<0.001)*	0.19 (0.021)*	ns
Locality (Urban vs Rural)	0.01 (0.767)	0.04 (0.675)	0.04 (0.716)
Household Income	0.14 (0.004)*	–0.06 (0.340)	0.12 (0.018)*
Mother's Education	0.21 (<0.001)*	ns	0.14 (0.023)*
Father's Education	ns	ns	ns
Model Fit (Adj. R^2)	0.15	0.05	0.05

*Note. Standardized β coefficients are shown. *p* < .05 considered significant. ns = not significant.

Associations between Sociodemographic Factors and Knowledge, Attitude and Practice

Multiple linear regression was performed to examine the predictive value of sociodemographic factors on knowledge, attitudes, and practice scores (Table 3.8).

For knowledge, maternal education (β = 0.21, p = 0.003) and household income (β = 0.19, p = 0.008) were significant predic-

tors, explaining 12% of the variance ($R^2 = 0.12$). This indicates that higher maternal education and household income were associated with higher knowledge scores, although the overall variance explained was modest.

For attitudes, ethnicity was the only significant predictor ($\beta = 0.18$, $p = .010$), accounting for 7% of the variance ($R^2 = 0.07$). Indian adolescents reported more positive attitudes compared to Malay and Chinese adolescents.

For practices, both household income and maternal education were significant predictors, explaining 15% of the variance ($R^2 = 0.15$). Adolescents from higher-income families and those with more educated mothers engaged in healthier practices.

Although these models were statistically significant, they explained only 5–15% of the variance in outcomes, suggesting that other unmeasured factors (e.g., school environment, peer influence, media exposure) also play important roles in shaping adolescent KAP.

Partial Correlations among Knowledge, Attitudes, and Practices

Partial correlations were conducted to examine the associations among knowledge, attitudes, and practices after controlling for household income and maternal education (Table 3.9).

Knowledge was significantly and positively correlated with practice ($r = 0.24$, $p = 0.002$), suggesting that adolescents with greater knowledge of healthy lifestyles were more likely to engage in healthier behaviours. This reflects a small-to-moderate effect size, suggesting that knowledge contributes meaningfully to behaviour.

The correlation between knowledge and attitudes was not statistically significant. Similarly, attitudes and practices were not significantly correlated. These results indicate that, in this sample, positive attitudes did not translate directly into healthier behaviours, highlighting a potential disconnect between intentions and actual practices.

Table 9: Partial Correlations among Knowledge, Attitudes, and Practices, Controlling for Household Income and Maternal Education.

Variable Pair	Partial r	p-value	Interpretation
Knowledge – Attitude	0.12	0.081	ns
Knowledge – Practice	0.24	0.002*	Small-to-moderate
Attitude – Practice	0.09	0.21	ns

*Note. Partial correlations adjusted for maternal education and household income.

p < .05 considered significant. ns = not significant.

Summary of Findings.

Overall, the findings of this study showed that overweight and obese adolescents in Gombak demonstrated moderate levels of knowledge and practice, alongside generally positive attitudes toward healthy lifestyles. Maternal education, household income, and ethnicity consistently emerged as sociodemographic predictors of KAP outcomes.

Independent t-tests indicated that adolescents with working and married mothers had significantly higher knowledge and practice scores, although the effect sizes were small to moderate. One-way ANOVA results revealed that Indian adolescents reported lower knowledge but more positive attitudes than Malay and Chinese peers, while adolescents from higher-income families and those with more educated mothers achieved higher knowledge and practice scores.

Regression analyses further confirmed that maternal education and household income significantly predicted knowledge and practice, while ethnicity predicted attitudes. However, these models accounted for only 5–15% of the variance, suggesting that additional contextual factors such as school environment, peer influences, and media exposure likely contribute to shaping adolescent KAP.

Partial correlation analyses showed that knowledge was positively associated with practice, whereas attitudes were not significantly associated with practice. This points to a gap between adolescents' favourable perceptions and their actual behaviours.

Discussion

Overview of Key Findings

This study examined knowledge, attitudes, and practices (KAP) related to healthy lifestyles among overweight and obese adolescents in Gombak, as well as their sociodemographic correlates. Overall, the results showed moderate levels of knowledge and practice, alongside generally positive attitudes. The most consistent predictors across KAP domains were maternal education, household income, and ethnicity. These findings reinforce evidence that adolescent health behaviours are shaped not only by individual knowledge but also by family context, cultural influences, and the wider environment [26].

The mean knowledge score of 21.34 out of 42 reflected a moderate level of knowledge. Attitudes towards healthy behaviours were largely positive, while practice scores varied more widely. Healthier behaviours were more often reported by adolescents from higher-income households and by those whose mothers had a tertiary education. Multivariable analyses confirmed that knowledge and practice were predicted by maternal education and household income, whereas attitudes were primarily influenced by ethnicity. Notably, Indian adolescents showed lower knowledge scores but more positive attitudes than their Malay and Chinese peers, suggesting that cultural framing may play an important role in shaping health perceptions.

Importantly, the findings also revealed a disconnect between attitudes and practices. Although adolescents generally expressed favourable attitudes towards healthy lifestyles, these attitudes did not consistently translate into healthier practices. This suggests that positive attitudes alone may be insufficient to drive behavioural change, especially in the face of socioeconomic and environmental barriers. From a theoretical perspective, this partly supports the KAP model: knowledge was significantly associated with practice, but the expected link between attitudes and practice was not observed. This emphasises the need to view adolescent health behaviours through a broader ecological lens, where individual cognitions interact with family, cultural, and structural influences.

Comparison with Literature

The level of knowledge in this study is consistent with reports from other Malaysian studies, where adolescents generally possess a broad awareness of nutrition and physical activity but demonstrate limited knowledge of specific aspects such as portion size, calorie balance, and long-term health risks [23, 27]. This pattern suggests that health education in schools may provide broad messages but not necessarily equip adolescents with the practical skills needed to apply this knowledge in daily life. Similar observations have been documented globally, where adolescents are often described as “superficially health literate,” reflecting the influence of their social and cultural environments [17].This reinforces the need for more experiential, skill-based approaches to health education that go beyond theoretical awareness.

The finding of generally positive attitudes toward health-promoting behaviours aligns with local evidence. [27] reported that Malaysian adolescents appreciated the importance of diet and exercise for maintaining health. However, consistent with [18] positive attitudes such as support for smoke-free environments do not necessarily translate into behavioural outcomes. This at-

titude–practice gap mirrors behavioural theories, which emphasise that intention alone is rarely sufficient to produce behavioural change, especially in the presence of structural and environmental constraints [28]. Therefore, this study adds to the literature by confirming this disconnect in a Malaysian adolescent population and underscoring the importance of addressing environmental supports alongside individual-level attitudes.

The variations in practice observed in this study, where adolescents from higher-income households and those whose mothers had higher levels of education reported healthier practices, echo findings from both regional and international studies. Pereira et al. (2015) demonstrated similar patterns of social inequalities in youth lifestyles across countries, while [28] highlighted that adolescent obesity results from individual behaviours nested within broader obesogenic environments. The present findings reinforce that knowledge and attitudes are necessary but not sufficient; structural antecedents such as family resources, school climate, and community infrastructure strongly condition whether healthy practices can be sustained.

The significant role of maternal education and income observed in this study is also consistent with Malaysian evidence, indicating that mothers serve as primary gatekeepers of dietary intake and role models for adolescents' health practices [23]. Importantly, the ethnic disparities identified, where Indian adolescents reported more favourable attitudes but lower knowledge, suggest that cultural framing influences how health is perceived, even in the absence of factual knowledge. While this pattern has been noted internationally [17], its emergence in a Malaysian context highlights the need for culturally sensitive interventions that acknowledge community norms and values. This finding extends existing literature by suggesting that interventions should move beyond improving factual knowledge to also bridging cultural attitudes with practical, sustainable behaviours.

These findings also reinforce the role of socioeconomic position as a structural determinant of adolescent health behaviours, echoing global evidence that inequities in education and household resources translate into inequities in lifestyle practices [28]. Addressing these disparities is central to achieving equity in adolescent health.

Strengths of the Study

This study has several notable strengths. First, it focused on overweight and obese adolescents, a subgroup at heightened risk of developing non-communicable diseases yet less frequently examined in Malaysia and underrepresented in adolescent obesity research globally. By targeting this high-risk group, the study provides insights that may inform more tailored interventions.

Second, the use of a validated instrument, the KAP-HLQ (CC et al., 2015), strengthened the study. Previous research has established its validity and reliability in measuring knowledge, attitudes, and practices. In this sample, Cronbach's alpha demonstrated acceptable internal consistency for the knowledge and attitude domains and moderate reliability for the practices domain, supporting its applicability among Malaysian adolescents.

Third, the relatively large sample size (N = 400) represents a strength compared to many similar KAP studies, providing sufficient statistical power to detect subgroup differences across sex, age, ethnicity, and socioeconomic status.

Finally, the analytic approach was broad and systematic, combining descriptive statistics, bivariate analyses, multivariable regression, and partial correlations. This enabled the exploration of relationships both in crude form and after adjustment for potential confounders, providing a more nuanced understanding of the determinants of KAP outcomes.

Limitations of the Study

The study is not without limitations. First, its cross sectional design does not permit causal inference between sociodemographic factors and KAP outcomes. For example, although maternal education and household income were associated with higher knowledge and practice scores, this design does not establish directionality or causation.

Second, the use of self-reported data for practices introduces the potential for recall bias and social desirability bias, whereby adolescents may have overestimated their engagement in healthy behaviours.

Third, the study relied on SEGAK BMI-for-age classifications to identify overweight and obese adolescents. Because BMI data were obtained from school health records rather than measured concurrently during the study, there is a possibility of misclassification bias. This should be acknowledged when interpreting the findings.

Fourth, the generalisability of the findings is also limited. While the sample included a useful cross-section of adolescents from urban and rural areas within Gombak, the results may not be applicable to adolescents in other districts or states with different demographic, socioeconomic, or cultural characteristics.

Another limitation is the absence of school and environmental factors, which are known to strongly influence adolescent health behaviours. Peer influences, canteen food environments, opportunities for physical activity, and exposure to digital and social media were not measured in this study [29, 30] Similarly, no qualitative data were collected, which could have provided richer insights into the observed attitude–practice disconnect and cultural differences.

Finally, the study did not include sensitivity analyses, such as stratification by sex or socioeconomic status, due to sample size constraints. The absence of these subgroup analyses restricts the ability to fully explore equity-related disparities in adolescent health behaviours.

Public Health Implications

The findings of this study have several important implications for public health. The strong influence of maternal education on both knowledge and practice suggests that interventions should target the family as a whole, particularly by empowering mothers as agents of change. Strengthening parental health literacy, especially among mothers, who often act as gatekeepers of diet and activity, could indirectly promote healthier behaviours in adolescents.

Household income also emerged as a significant determinant of knowledge and practice, highlighting the role of socioeconomic disparities in shaping adolescent health. This points to the importance of equity-focused strategies that address structural barriers such as food insecurity, limited access to healthy foods, and inadequate opportunities for physical activity. Measures such as subsidies for nutritious foods, affordable recreational facilities, and school-based programmes could help reduce health inequities. These priorities align with national strategies, including the Health White Paper (MOH, 2023) and the National Plan of Action for Nutrition of Malaysia III (NCCFN, 2016–2025), which emphasise tackling upstream determinants to reduce health inequalities.

Ethnicity was also shown to influence knowledge and attitudes, underscoring the value of culturally responsive health promotion. Interventions tailored to community norms and values are more likely to gain acceptance and be effective. For example, approaches designed for Indian adolescents may need to focus on translating positive attitudes into actionable knowledge and practice.

Finally, the disconnect observed between knowledge, attitudes, and practices highlights the importance of supportive environments that enable adolescents to act on what they know and believe. Raising awareness and fostering positive attitudes are insufficient if adolescents lack the means to put them into practice. School-based education, improvements in the nutritional quality of canteen food, and safe community spaces for exercise are critical to bridging this knowledge-practice gap and supporting long-term behaviour change [27, 29].

Recommendations for Future Research

Future research should adopt longitudinal designs to clarify causal relationships between sociodemographic factors and adolescent health behaviours, and to test the KAP framework more rigorously, particularly the role of attitudes in linking knowledge to practice.

Mixed-method approaches, combining surveys with qualitative interviews, would provide deeper insight into the observed disconnect between attitude and practice and ethnic differences by capturing adolescents' lived experiences and cultural contexts.

Subsequent studies should also consider school and environmental influences such as food environments, peer dynamics, and access to recreational facilities in line with national initiatives like the Health White Paper (MOH, 2023).

To improve generalisability, future work should expand to other districts and states, allowing for comparisons across Malaysia's diverse sociocultural settings.

Finally, intervention studies are needed to test the effectiveness of strategies such as school-based nutrition education, parental involvement programmes, and culturally tailored campaigns, and to evaluate their impact on KAP outcomes and obesity prevalence.

Conclusion

This study examined the knowledge, attitudes, and practices (KAP) related to healthy lifestyles among overweight and obese adolescents in Gombak, Malaysia. The findings revealed moderate levels of knowledge and practice but generally positive attitudes, underscoring a persistent gap between what adolescents know and how they behave.

Maternal education and household income consistently predicted healthier practices, while ethnicity shaped attitudes regardless of knowledge levels. Notably, Indian adolescents expressed more positive attitudes despite lower knowledge, underscoring the influence of cultural framing on health perceptions. These findings suggest that interventions must go beyond information provision and incorporate socioeconomic and cultural considerations.

The observation that knowledge was only moderately associated with practice reinforces international evidence that awareness alone does not necessarily result in sustained behaviour change [17]. Adolescents face multiple barriers, including peer pressure, food environments, and the desire for autonomy, that need to be addressed if healthier practices are to be achieved and maintained.

This study contributes to the limited Malaysian literature on adolescent overweight and obesity by applying a validated KAP instrument with robust analytical methods. However, its cross-sectional design precludes causal inference, and the use of self-reported measures may have introduced bias.

In conclusion, the findings both support and challenge the KAP framework: while knowledge was linked to practice, attitudes did not consistently predict behaviour. Effective interventions will therefore require a multi-level approach that addresses psychosocial and socioeconomic determinants, empowers families, particularly mothers, through targeted health literacy, strengthens school health programmes, and builds enabling environments. Such strategies are critical to fostering sustainable, healthy behaviours and preventing obesity-related non-communicable diseases in Malaysia.

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