ORIGINAL ARTICLE

Prevalence of Vegetable Intake and its associated Personal, Socio-environmental, Physical-environmental Factors among Malay Adolescents in Rural Terengganu

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ABSTRACT

Introduction: This study was carried out to determine the prevalence of vegetable intake and its associated personal, socio-environmental and physical-environmental factors among Malay adolescents in rural Terengganu. **Methods:** This study was a cross-sectional study conducted from 1st January 2019 to 31st May 2019 at selected secondary schools in rural Terengganu in Marang and Hulu Terengganu districts. A total of 240 students were recruited by multistage random sampling method in schools and based on inclusion criteria. A validated questionnaire was developed consisting of four (4) sections; demographic data, personal, socio-environmental and physical-environmental factors of vegetable intake. Reliability test found the validity and internal consistency of the questionnaire to be acceptable with a Cronbach Alpha value of 0.762. **Results:** The respondents consisted of 53% males and 47% females with mean age of 15.01 (1.00) years old. Majority of the respondents had normal BMI status (48%) follows by underweight (20%), overweight (16%) and obese (16%). Majority (83%) had inadequate vegetable intake per day. Factors that were associated with the vegetable intake among adolescents were liking (p=0.01), intention (p=0.01) and habit (p<0.01) for personal factor. An availability of vegetable at leisure place (p=0.01) was significant for physical-environmental factor. **Conclusion:** Majority of the adolescents did not meet the recommended intake of vegetable daily. Therefore, development of intervention programs to promote intake of vegetables among adolescents should consider their liking, habits, intention and the availability at leisure place compare to others in schools or any organizations.

Keywords: Vegetable intake, Rural Terengganu, Personal, Socio-environmental, Physical-environmental

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INTRODUCTION

According to Adolescent Nutrition Survey (1), Malaysian adolescents were reported to have low vegetable intake, with 92.2% did not meet the recommended intake of vegetable. Peltzer & Pengpid (2) also reported that 76.3% of adolescents in Asian countries did not meet the recommended intake of vegetable, with mean of vegetable consumed per day was 1.9 servings. World Health Organization (WHO) had stated that vegetable intake is a part of a healthy diet and essential in daily life (3). Promotion of vegetables intake had been shown for healthy body function and prevention of non-communicable diseases by its nutrients and bioactive compounds contents especially during adolescent phase (4).

Adolescence is a transitional phase of dependency and preparation of legal adulthood through changes of cultural norms, habits or parenting (5). Among the changes, dietary habits play an important role in disease development during adulthood (6), as the dietary pattern or habits during adolescence period continue into adulthood (7). Augusto et al. (8) had reported low intake of vegetable during adolescence was associated with high risk of nutritional deficiencies and developing nutritional-deficiency problems. Therefore, promotion of adequate vegetable intake must be practiced since adolescence to prevent health-related problems during adulthood.

In previous study, De Bourdeaudhuij et al. (9) had investigated personal, socio-environmental and physical-environmental correlates of vegetable intake in European countries. The results observed that mediators in each factor has an important impact upon the vegetable consumption among respondents. Hence, these factors related to vegetable intake is warranted because it can be

targeted as mediating variables in intervention programs. Nevertheless, no studies have been done among Malays adolescent's correlates with recommended guidelines of vegetable intake (10). Therefore, the study aim to determine the prevalence of vegetable intake and the association of personal, socio-environmental, physical-environmental and anthropometric factors with vegetable intake among Malay adolescents in rural Terengganu.

MATERIALS AND METHODS

Study design and study population

This was a cross-sectional study conducted from 1st January 2019 to 31st May 2019, with a total duration of the study was 5 months. The sample size used for this study was determined using two proportion formula using Power and Sample Size Calculation (PS) software program version 3.1 (Informer Technologies, Inc., USA). Based on Draxten et al. (11), the proportion of having adequate vegetable intake among respondents who have low and high parental role modelling of vegetable intake at snack were 12.0% (P0) and 27.0% (P1), respectively. The level of significance was set at 0.05 and power of the study was 0.8. By considering 20% of dropout rate, the final sample size selected in this study was 240.

In this study, multistage random sampling was used to select school with two rural secondary schools were selected in each district, Marang and Hulu Terengganu. Meanwhile, random sampling was implemented involving 240 respondents being drawn from students' population. The inclusion criteria of the respondents were both males and females Malaysians who aged 14 and 16 years old, studying and living in rural Terengganu of Marang and Hulu Terengganu districts and have parental consent to participate in this study. Non-Malaysian respondents and respondents having physical or medical conditions that influence normal dietary intake were excluded. Ethics approval was obtained from the Research Ethics Committee of Faculty of Health Sciences, Universiti Sultan Zainal Abidin (UniSZA) with reference number UniSZA.C/2/UHREC/628-2 (55). The study was also being approved by the Ministry of Educational Malaysia with register number, KPM.600-3/2/3-eras (1316).

Data collection

Prior to data collection, a consent letter was distributed to all respondents to obtain their agreement. Out of 320 consented form distributed to students' population, 80.0% respondents returned completed information (n=255). The total number of respondents was acceptable based on minimum requirement from the sample size calculation with 20% dropout rate by 240. After consent from parents were obtained, the respondents attended anthropometric measurement session and interview session conducted by the researcher for Food Frequency Questionnaire regarding dietary vegetable intake and questionnaire design.

Part 1: Anthropometric assessments

Anthropometric assessments consisted of measuring weight and height was applied according to Mohd Adzim Khalili Rohin et al. (12, 13). Body weight of respondents were measured in a light clothing with their shoes removed by using SECA 813 digital flat scale (Hamburg, Germany) to the nearest 0.1 kg. On the other hands, the height of respondents was measured with their shoes removed by using Seca 217 Model Portable Stadiometer (Hamburg, Germany) to the nearest 0.1 cm. BMI of the respondents were calculated and analysed by using WHO Anthro Plus Version 3.2.2 (14). The Z-score or standard deviation obtained from the software were used to classify the BMI of the respondents based on WHO BMI classification for adolescent (14).

Part 2: Food Frequency Questionnaire (FFQ)

A validated MyUM Adolescent Food Frequency Questionnaire (FFQ) (15) was used to measure the frequency of vegetable intake of the respondents. Based on Hazreen et al. (16), an open-ended data collective food data from the 7-day diet history obtained from the MyHeARTs population-based study conducted in 2012 was used to construct the FFQ. The method used by Khalili et al. (17) was done accordingly by collected dietary intake of vegetables with a questionnaire in a face-to-face interview with the respondents. The questionnaire consisted of 24 vegetable items which classified into 6 groups, which were, green vegetable, legumatous vegetable, cruciferous vegetable, fruits vegetable, root and tuberous vegetable and others. The respondents were asked specifically on vegetables intake portions and the frequency recorded in nine categories including “never”, “less than once per month”, “one to three times per month”, “once a week”, “two to four times a week”, “five to six times a week”, “once a day”, “two to three times a day”, “four to five times a day” and “six times a day or more”. For each vegetable item listed, respondents must choose only one column, and placed one checkmark in that column that best describes how often the respondents ate a given vegetables item. A flip chart with colour illustrations of household measurement utensils and the portions of vegetable items was prepared based on the Malaysian Atlas of Food Exchanges and Portion Sizes (15). For recommended guidelines, MDG for Children and Adolescents (10) had specifically recommends adolescents aged 10-18 years old to consume at least 3 servings of vegetable daily.

Part 3: Questionnaire design and reliability test

A self-administered questionnaire in this study was an adapted version of validated questionnaires for personal, social and physical-environmental correlates of fruits and vegetable intake in European countries (18). The researcher had adapted the questionnaire on similar factors towards vegetable intake and translated in Malay languages. The reliability test and internal consistency of the questionnaire were tested in a pilot study involving 30 students. These respondents were not involved

in the final survey. By using Cronbach Alpha test, the reliability coefficient obtained for the questionnaire was 0.762, considered acceptable internal consistency (19). Following that, several items in the questionnaire were modified to improve clarity. This questionnaire consisted of four (4) sections, namely socio-demographic background, personal factor, socio-environmental factor and physical-environmental factor regarding vegetable intake.

Section 1: Socio-demographic background

This section included five (5) questions regarding socio-demographic information such as gender, age (years), weight, height and BMI.

Section 2: Personal factor of vegetable intake

This section consisted of 6 questions that were involved mediators of knowledge, attitude, liking, self-efficacy, intention and habit of personal factor on vegetable intake. Responds were given on 5-point Likert scales answers ranging from fully agree (+2); likely agree (+1); not arguing nor agreeing (0); more likely disagree (-1) and fully disagree (-2). The collected scales were reported as mean (SD) and were then associated with the vegetable intakes follows by recommended guidelines (10).

Section 3: Socio-environmental factor of vegetable intake

This section consisted of 7 questions that were involved mediators of parental encouragement, parental demand, parental allowance, parental modelling and peer modelling. Responds were given on 5-point Likert scales answers ranging from fully agree (+2); likely agree (+1); not arguing nor agreeing (0); more likely disagree (-1) and fully disagree (-2). The collected scales were reported as mean (SD) and were then associated with the vegetable intakes follows by recommended guidelines (10).

Section 4: Physical-environmental factor of vegetable intake

This section consisted of 6 questions that were involved regarding availability of vegetable at home, school, and friend's house and at leisure place. Responds were given on 5-point Likert scales answers ranging from very often (+2); most of days (+1); sometimes (0); seldom (-1) and never (-2). The collected scales were reported as mean (SD) and were then associated with the vegetable intakes follows by recommended guidelines (10).

Statistical analysis

Descriptive statistic for socio-demographic information and prevalence of vegetable intake were presented as frequencies and percentages. The statistical analysis was computed by using the IBM Statistical Package for the Social Sciences (SPSS), version 22.0 software (IBM Corp. Armonk, NY, US). Results were expressed as mean and standard deviation for each mediators in personal, socio-environmental and physical-environmental factors towards vegetable intakes. Association between groups of vegetable intake were performed using Pearson's Chi Square test / Fisher's Exact test regarding personal, socio-environmental, physical-environmental. A p-value of less than 0.05 ($p<0.05$) was considered to be statistically significant.

RESULTS

Demographic characteristics of respondents

Based on Table I, the demographic data were available for 240 respondents. In this study, 53% of the respondents were males and 47% were females. Meanwhile, a total of 121 (51%) respondents were form four students (16 years old) and 119 respondents (49%) were form two students (14 years old), with mean 15.01 (1.00) years old. All of the respondents (100%) were from one ethnicity (Malays).

Anthropometric assessment of respondents

The weight (kg), height (cm) and BMI status (kg/m^2) of the respondents are tabulated in Table I. Anthropometric assessment showed that mean of weight and height were 51.94 (15.61) kg and 154.15 (8.15) cm, respectively. Result showed respondents had normal mean weight-for-age based on CDC standard for both male and female (20, 21). However, only female respondents had normal mean height-for-age based on CDC standard (20, 21). Mean BMI of the respondents was 21.90 (5.79) kg/m2; with normal weight status based on CDC standard (22, 23). Based on BMI status, 48% of the respondents had normal BMI with the remaining respondents with underweight (20%), overweight (16%) and obese (16%).

Table I: Socio-demographic data of respondents (n = 240)

	N (%)	Mean (SD)
Gender		
Male	127 (53)	
Female	113 (47)	
Age (years)		15.05 (1.01)
14	119 (49)	
16	121 (51)	
Height (cm)		154.15 (8.15)
Weight (kg)		51.94 (15.61
BMI status (kg/m2)		21.90 (5.79)
Underweight	3 (2)	
Normal	185 (77)	
Overweight	32 (13)	
Obese	20 (8)	

Prevalence of vegetable intake by gender, age and BMI

As shown in Table II, most of the adolescents (83%) in rural Terengganu consumed less than three servings of vegetable intake per day (< 3 servings of vegetable/day). The result indicated most of the respondents were having inadequate vegetable intake since the recommended daily intake is three or more servings per

Table II: Prevalence of vegetable intake among respondents by gender, age and BMI (n = 240)

	Vegetable intake (<3 servings/day) N (%)	Vegetable intake (≥ 3 servings/day) N (%)
Overall	198 (83)	42 (17)
Gender		
Male	102 (80)	25 (20)
Female	96 (85)	17 (15)
Age (years)		
14	101 (85)	18 (15)
16	97 (80)	24 (20)
BMI status (kg/m2)		
Underweight	1 (33)	2 (67)
Normal	150 (81)	35 (19)
Overweight	20 (63)	12 (37)
Obese	15 (75)	5 (25)

day (≥ 3 servings of vegetable/day) (10). Following by, both females (85%) and males (80%) mostly reported having less than three servings of vegetable per day. Nevertheless, males were observed to consume three or more servings of vegetable per day with 25 respondents compared to 17 respondents of females.

On the addition, majority of 14 (84.9%) and 16 (80.2%) years old respondents also reported having less than three servings of vegetable per day. More respondents aged 16 (19.8%) consumed three or more servings of vegetable per day than 14 years old (15.1%), indicated they met the recommended intake by MDG for Children and Adolescents (10). Regarding BMI status, respondents who had normal BMI (16%) were more likely to consume three or more servings of vegetable per day than respondents who had BMI status of underweight (0%), overweight (1%) and obese (1%).

Association of personal, socio-environmental and physical-environmental factors with vegetable intake

Personal factors

Overall, the mediators of personal factor among the respondents included knowledge, attitudes, liking, self-efficacy, intention and habits. The study showed that majority of the respondents agreed on 'likely agree' scale on liking (37.3%), self-efficacy (32.4%), intention (32.8%) and habits (29.9%) (Table III). Meanwhile, 83.8% of the respondents agreed on 'nor arguing nor agreeing' scale for knowledge and 55.2% 'fully agree' scale for attitudes.

Among the adolescent respondents, there was three significant difference of personal factors mediators associated with vegetable intakes. Liking (p=0.02), intention (p=0.01) and habits (p=<0.01) were reported significantly associated with vegetable intake, as been depicted in Table IV. For this mediators, the associations had higher scale in group of more than 3 servings of vegetable intake per day (liking 1.07 (1.04); intention 0.85 (1.27); habits 0.88 (1.13)) as compared to the group less than 3 servings of vegetable intake per day.

This indicates respondents who having 3 or more servings of vegetable intake per day have preferable on

Table III: Personal, socio-environmental and physical-environmental factors and vegetable intake among adolescents in rural Terengganu (n =240)

	Fully agree/ Very often	Likely agree/ Most of days	Nor arguing nor agreeing/ Sometimes	Likely disagree/ Seldom	Fully disagree/ Never
			Personal		
Knowledge	0	38 (15.8)	202 (83.8)	0	0
Attitudes	33 (55.2)	84 (34.9)	11 (4.6)	10 (4.1)	2 (0.8)
Liking	53 (22.0)	90 (37.3)	39 (16.2)	38 (15.8)	20 (8.3)
Self-efficacy	34 (14.1)	78 (32.4)	47 (19.5)	47 (19.5)	34 (14.1)
Intention	56 (23.3)	79 (32.8)	38 (15.8)	41 (17.0)	26 (10.8)
Habit	39 (16.2)	72 (29.9)	53 (22.0)	50 (20.7)	26 (10.8)
			Socio-environmental		
Parental encouragement	104 (43.2)	84 (34.9)	27 (11.2)	16 (6.6)	9 (3.7)
Parental demand	96 (39.8)	63 (26.1)	62 (25.7)	9 (3.7)	10 (4.1)
Parental allowance	107 (44.4)	58 (24.1	43 (17.8)	22 (9.1)	10 (4.1)
Parental modelling	136 (56.4)	79 (32.8)	16 (6.6)	6 (2.5)	3 (1.2)
Peer modelling	50 (20.7)	88 (36.5)	60 (24.9)	34 (14.1)	8 (3.3)
			Physical-environmental		
Availability at home	35 (14.5)	128 (53.1)	53 (22.0)	22 (9.1)	2 (0.8)
Availability at school	25 (10.4)	28 (11.6)	54 (22.4)	52 (21.6)	81 (33.6)
Availability at friend's house	18 (7.5)	22 (9.1)	65 (27.0)	61 (25.3)	74 (30.7)
Availability at leisure place	18 (7.5)	24 (10.0)	50 (20.7)	67 (27.8)	81 (33.6)

Data represented as mean (SD)

Table IV: Association between personal, socio-environmental and physical-environmental factors and vegetable intake among adolescents in rural Terengganu (n =240)

	Vegetable intake (< 3 servings/day) (n=198)	Vegetable intake (≥ 3 servings/day) (n=42)	p-value
	Personal		
Knowledge	0.16 (0.37)	0.14 (0.35)	[a]0.76
Attitudes	1.37 (0.83)	1.55 (0.80)	[b]0.97
Liking	0.37 (1.23)	1.07 (1.04)	[a]0.02*
Self-efficacy	0.17 (1.27)	-0.05 (1.32)	[a]0.84
Intention	0.31 (1.30)	0.85 (1.27)	[a]0.01*
Habit	0.06 (1.22)	0.88 (1.13)	[a]<0.01**
	Socio-environmental		
Parental encouragement	0.97 (0.08)	1.17 (1.10)	[a]0.39
Parental demand	0.91 (1.07)	1.07 (1.13)	[a]0.25
Parental allowance	0.92 (1.20)	1.14 (0.97)	[a]0.13
Parental modelling	1.34 (0.08)	1.39 (0.17)	[b]0.78
Peer modelling	0.55 (1.07)	0.69 (1.05)	[a]0.77
	Physical-environmental		
Availability at home	0.54 (0.08)	0.90 (1.14)	[a]0.37
Availability at school	-0.61 (1.30)	-0.38 (1.49)	[a]0.13
Availability at friend's house	-0.72 (1.20)	-0.21 (1.22)	[a]0.07
Availability at leisure place	-0.83 (1.18)	-0.12 (1.37)	[a]0.01*

Data represented as mean (SD)
[a]Pearson's Chi Square Test was applied
[b]Fisher Exact Test was applied
*$P < 0.05$
** $P < 0.001$

vegetables, intend to consume it every day and made the consumption as habits in their daily life. In contrary, respondents' knowledge about recommended daily intake of vegetable (p=0.76), self-efficacy (p=0.84) and attitude (p=0.97) towards eating vegetable were not significantly associated with vegetable intake (Table IV).

Socio-environmental factors

Study found that only minority of the respondents gives 'fully disagree' on parental encouragement (3.7%), parental allowance (4.1%), parental modelling (1.2%) and peer modelling (3.3%) towards vegetables intake (Table III). The results observed the respondents have active parental involvement in family rule and family facilitation regarding consumption of vegetables in their daily life. However, there are no significant differences among the mediators of socio-environmental factor towards vegetable intake (p<0.05) (Table IV).

This indicates respondents having active socio-environmental factor does not necessarily having adequate or inadequate intake of vegetable as per recommended (10). For active socio-environmental factor, the mediators gives higher scale in the group having 3 or more servings of vegetable intake per day with parental encouragement (1.17 (1.10)), parental demand (1.07 (1.13)), parental allowance (1.14 (0.97)), parental modelling (1.39 (0.17)) and peer modelling (0.69 (1.05)) compared to the group less than 3 servings of vegetable intake per day (Table IV).

Physical-environmental factors

As for the physical-environmental factor, 128 of the respondents agreed there are 'very often' availability of vegetables at home and only 22 of the respondents noted 'seldom' (Table III). Contrary, majority of the respondents agreed on 'never' for availability of vegetables at school (33.6%), at friend's house (30.7%) and at leisure place (33.6%).

The availability of vegetable at places for leisure time activities (p=0.01) was found significantly associated with adolescents' vegetable intake (Table IV). Nevertheless, there was no significant association between availability of vegetable at home (p=0.37), at school (p=0.13) and at friend's house (p=0.07) towards vegetable intake. This indicates availability of vegetable at home, at school and at friend's house do not influence the adequate or inadequate intake of vegetable among adolescents.

DISCUSSION

The present study found that most of the adolescents (82.5%) in rural Terengganu consumed less than 3 servings of vegetable intake per day; indicated most of them were having inadequate vegetable intake. As the present study was conducted in rural area of Terengganu, the result was expected as the pattern of vegetable intake may affected by various factors such as economic and educational factors (24). Similar study was reported in rural area of Northeast Brazil where

the prevalence of inadequate vegetable intake among adolescents was 88.6% (25).

In contrary, a study by Xavier et al. (26) which conducted in Brazil have shown that most of the adolescents in rural area consumed adequate vegetable daily. Nevertheless, a study by Doku et al. (27) in Ghana observed that there was no difference in vegetable intake between rural adolescents and urban adolescents. The discrepancies among different study could be due to different factors, mediators and population involved. Therefore, the present study issued the personal, socio-environmental and physical-environmental factors towards consumption of vegetable among Malay adolescents.

Previous, a number of studies have already investigated psychosocial and environmental correlates of food in general (28) and vegetable intake among children (29). On the addition, study from Wind et al. (30) and Sandvik et al. (31) showed that daily intake of vegetables among children was primarily linked to knowledge of the organization recommendations, positive self-efficacy, positive liking and preference, and parental modelling and demand. Therefore, data collected regarding the vegetable intake among adolescents in rural area on personal, socio-environmental and physical-environmental factors had gave crucial information in this study.

Following, personal factors such as liking, intention and habit were significantly associated with vegetable intake among adolescents ($p<0.05$) compared to knowledge, attitudes and self-efficacy ($p>0.05$). Previous study detailed that personal or individual factors are the major factor in dietary habits as they are individual subjective norms or behaviours from child until adulthood in everyday life (32). Hence, the present results indicate that the respondent's liking, intention and habit is an important associate of healthy eating behaviour individually.

It was supported by Louis et al. (33), who observed that individual norm was associated with healthy eating intentions, which in turn, predicted self-reported healthy eating. Nevertheless, Lotrean & Tutui (34) indicated that knowledge and self-efficacy in eating vegetables daily were associated well with higher consumption of vegetables among adolescents. The preference may also have been noted as a key factor in deciding easier vegetables consumption, which could be further clarified by the unpleasant human inherent taste and vegetable smells (35, 36).

Other than personal or individual factor, familial and modelling factor also had been studies with the vegetable consumption (32, 34). Previous, de Bruijn (37) detailed on the combination of individual and family norms and it turns out to be a most significant predictor of vegetable consumption in college students in Netherlands. Moreover, Hartman et al. (38) also pointed out that familial and partners had the greatest social influence on university students. The explanation may be that the mother is the main person responsible for the family's cooking and preparing of vegetable foods, thereby affecting the actions of her child through direct modelling (34).

Contrarily, there is no significant association among parental encouragement, demand, allowance, modelling and peer modelling towards vegetable intakes in the present study ($p>0.05$). Though, present study showed higher perceived of socio-environmental factor among respondents having adequate intake of vegetables. On the other hand, the fact that there is no significant association among familial and peer modelling may due to the dominant perceived of individual or personal factor towards inadequate intake of vegetables. Even though modelling from familial had been proved to increase motivation to make healthy choices (39, 40), it might more effective to improve personal or individual subjective norm concerning healthy eating (40).

In adolescent, the intake of vegetables may also influenced by physical-environmental factor which is the availability of vegetables at home, school, friend's house and leisure place. Although previous study has pointed out the importance of physical-environmental influence on eating behaviours (29, 41), the present study only showed significant association on availability of vegetable at leisure place such as sport place, recreation park or club towards vegetable intake ($p<0.05$). Others availability places such as at school and friend's house would appear to be more difficult to access vegetable for the respondents.

Thoroughly, the point that other physical-environmental factors were found not to be significant in relation to vegetable intake could be explained by the fact that the study only assessed perceived physical environment as possible barriers, rather than objectively measuring physical environmental factors (40). On the other hand, the adolescents may depends fully on the availability of vegetable for consumption at home or school as they spend mostly their times at these places (42). Therefore, the physical-environmental factor expected that greater availability to vegetable would increase the vegetable intake and vice-versa.

CONCLUSION

In conclusion, most of the adolescents (82.5%) in rural Terengganu were having inadequate intake of vegetable per day (less than 3 servings per day). Based on the result, liking, intention, habits and availability at leisure place mediators gives significant association towards vegetable consumption among adolescents ($p<0.05$). However, socio-environmental factors regarding parental mediators of encouragement, demand, allowance and modelling

didn't gives significant associated with adolescent's vegetable intake (p>0.05).

Therefore, these findings can be used by parents, schools or any organization to carry out intervention programs to increase intake of vegetable among Malay adolescents. The intervention programs could include promotion of vegetable intake through seminars, competitions and also by parent's encouragement. Nevertheless, future studies are needed for socio-economic status (SES) factor investigated since rural area may had poor SES and thus limit the intake of vegetable among Malay adolescents.

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