

The association of the hydration status and parental knowledge on fluid consumption with children's weight status in Malaysia

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Abstract

Introduction: Hydration and obesity play an important role in body weight regulation.

Objective: To determine the association of hydration status and parental knowledge on fluid intake with the children's weight status in Muar, Johor, Malaysia.

Method: A total of 207 children, 7-13 years of age, and their parents participated in this cross-sectional study. Parental fluid consumption knowledge questionnaire and beverage questionnaire were used to assess parent's knowledge on fluid consumption and children's fluid intake consumption, respectively. Body weight and height were measured and body mass index (BMI) was calculated.

Results: A total of 24.7% of the children were overweight. Majority (78.7%) of the children were insufficiently hydrated while 78.7% parents had poor fluid consumption knowledge. Parental fluid consumption knowledge was associated with children's hydration status ($\chi^2=47.788$; $p<0.001$) as significantly more parents had good knowledge on fluid consumption when children were sufficiently hydrated (59%) compared to insufficiently hydrated (11%). Similarly, hydration status was associated with children's BMI ($\chi^2=9.065$; $p=0.011$) where significantly more overweight children were insufficiently hydrated (88.5%) compared to sufficiently hydrated children.

Conclusion: Parental fluid consumption knowledge was significantly associated with children's hydration status. Hydration status was significantly associated with children's BMI.

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Introduction

In Malaysia, the prevalence of overweight and obesity in children was reported to have increased from 20.7% in 2002 to 26.5% in 2008¹ and to 28.9% in 2013^{1,2}. Focusing on dietary intake of growing children is vital with more emphasis given to the basics of nutrition such as hydration³. The impact of water intake on energy consumption was mostly done among adults and water was found to have positive impact on body weight regulation⁴. According to Popkin BM et al, there was a fairly complex linkage found between water consumption and energy intake⁵. It was suggested that the risk for school children getting overweight could be reduced by 31% if they had good hydration status. It was also found that drinking water can fulfil hydration requirement without providing any additional energy⁶. The role of water in regulating body weight was shown by Muckelbauer R et al. whereby dehydrated children are more likely to be overweight³. Children with lower hydration status are more likely to consume higher energy intake while children with higher hydration status would have healthier dietary choices³.

Although parents' general nutrition knowledge may not affect their children's diet, 75% of studies showed that parents' nutrition knowledge has implication on their child health outcomes⁷. Beverages are significant in a child's diet, making it almost 20% of energy contributor for children's intake³. Parents believed that serving sweetened drinks such as cordial is a method to provide fluid for their children⁸. Sugar sweetened beverages (SSB) have been found through meta-

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analysis to be a main contributor to weight gain among children⁹; hence water should be the main source of hydration to help curb obesity among this group.

Despite such findings in the past, there is lack of published studies examining hydration status of the children and parents' knowledge on fluid consumption in relation to children's weight status in Malaysia. Hence, there is a need to determine the relationship between parents' knowledge on fluid consumption with hydration and weight.

Objective

To assess parents' knowledge on fluid consumption, hydration status and weight status of children in Johor Bahru, Malaysia.

Method

Study setting and subjects

This study was approved by the Ethics Committee of Research and Scholarly Activities (RSA) of the Faculty of Applied Sciences, UCSI University. Approval to conduct the study in respective tuition/learning centres in Johor Bahru, Malaysia was obtained from respective centres. Respondents and their parents were informed of the purpose of this study through information sheets distributed to the school children in the learning centres. Signed consent forms were obtained from the respondents and their parents prior to the data collection.

This is a cross-sectional study conducted in tuition/learning centres among children and adolescents aged 7 to 13 years old in the state of Johor Bahru, Malaysia. Respondents were recruited using a convenience sampling method whereby 6 tuition/learning centres were approached. All children from all classes in the tuition/learning centres were invited to participate. Teachers distributed parental consent forms to parents via the students. A total of 207 child-parent pairs provided their consent to participate in the study. Data collection commenced in October and was completed in November 2014.

Parent-administered questionnaire

Socio-demographic background: This section consisted of six questions that were used to assess the socio-demographic background of the parent and child. The information gathered were mainly date of birth of the child, age of the child,

gender of the child, parent's highest educational level, parent's occupation and household monthly income.

Parents' fluid consumption knowledge: Parent's fluid consumption knowledge is a self-administered questionnaire created specifically for this study according to the "Healthy Hydration Guide for Children aged 4-13 years"¹⁰ to obtain the knowledge of parents on fluid consumption. Parents' knowledge was assessed through fifteen statements about common knowledge on fluid intake for their growing children. Example of statements included: "Drinking extra water or forced drinking when not thirsty is a way to lose weight". Response options were correct (1), incorrect (0) or did not know the answer (0), and were then summed to compute a total score on knowledge with minimum score of 0 and a maximum score of 15. The overall fluid knowledge scores were later categorized as poor (less than 11), satisfactory (11-12) and good (more than 12).

Daily fluid intake of children: Beverage Intake Questionnaire (BEVQ-15) is a brief self-administered questionnaire used to assess habitual beverage intake of children¹¹. It is a semi-quantitative food frequency questionnaire that estimates habitual mean daily intake of water, total beverages and sugar-sweetened beverages. The original BEVQ-15 consisted of fifteen beverage categories including water, 100% fruit juice, sweetened juice beverage or drink, whole milk, reduced fat milk, low fat/fat free milk, soft drinks, diet soft drinks/artificially sweetened drinks, sweetened tea, tea or coffee with cream or super, tea or coffee black with/without artificial sweetener, alcoholic drinks such as beer, hard liquor, wine and lastly energy/sport drinks. For the purpose of this study, three categories of the alcoholic beverages namely beer, hard liquor and wine were excluded so that only twelve categories of beverages were used to assess the habitual beverage intake of the children. Respondents were asked to indicate "how often" and "how much" of a beverage they consumed in the past week. Responses for "how often" category ranged from "never or less than once per week" up to "3+ times per day"; "how much" ranged from "less than ¼ cup" up to "more than 2 ½ cups". The amount of fluid consumed by children per day was calculated from total fluid intake per week divided by 7 days. The children who met the daily fluid intake

requirements according to the Malaysian Dietary Guidelines for Children and Adolescents¹² were classified as sufficiently hydrated while those that did not meet the guidelines were classified as insufficiently hydrated.

Anthropometric Measurements

Body weights of the respondents were measured to the nearest 0.1kg using OMRON Bioelectrical Impedance Analyser (BIA) (Model HBF-356, Japan). Height was measured to the nearest 0.1 cm using a SECA Body Meter 206. Body mass index (BMI) was calculated and weight status of the respondents was determined according to the International Obesity Task Force (IOTF) definitions of overweight and obesity in children and adolescents¹³. The waist circumferences of the children were measured using a body measuring tape to the nearest 0.1 cm to determine abdominal obesity. The 90th percentile was used as the cut-off point to assess abdominal obesity¹⁴.

Data Analysis

Data were analyzed using IBM SPSS Statistics (Version 22.0). Frequency was used to present the demographic characteristics of the subjects. Independent samples T-test was used to determine the mean difference of anthropometric measurements, parents' knowledge on fluid consumption and daily fluid intake of the children between the male and female subjects. Chi-square analysis was conducted to examine the association between parents' knowledge on fluid consumption and hydration status of the children. Independent T-test and One-way ANOVA were used to compare the differences in BMI for socio-demographic factors, parents' knowledge on fluid intake and hydration status. Pearson correlation was used to determine the correlation between daily fluid intakes with BMI. Statistical significance was set at $p < 0.05$.

Results

A total of 207 children (7-13 years of age) and their parents consented and completed the study. The socio-demographic characteristics of the

respondents are shown in Table 1. The mean age of the children was 9.73 ± 1.99 years.

Table 1
Socio-demographic characteristics of respondents (n=207)

Socio-demographic characteristic	Number (%)
<i>Child Gender</i>	
Male	112 (54.1)
Female	95 (45.9)
<i>Age (years)</i>	
07	30 (14.5)
08	48 (23.2)
09	25 (12.1)
10	19 (09.2)
11	37 (17.9)
12	25 (12.1)
13	23 (11.1)
<i>Ethnicity</i>	
Malay	19 (09.2)
Chinese	186 (89.9)
Indian	02 (01.0)
<i>Parent gender</i>	
Male	34 (16.4)
Female	173 (83.6)
<i>Parent educational level</i>	
Primary	24 (11.6)
Secondary education	87 (42.0)
Pre-university	42 (20.3)
Degree	10 (19.3)
Masters & PhD	14 (06.8)
<i>Monthly household income</i>	
< RM1500	17 (08.2)
RM1500– RM2999	38 (18.4)
RM3000– RM4499	57 (27.5)
RM4500– RM5999	30 (14.5)
> RM6000	65 (31.4)

Note: RM 1500=USD 360; RM 3000= USD 767; RM 4500=USD 1151; RM 6000=USD 1533

The anthropometric indices, daily fluid intake and parents' knowledge on fluid consumption are presented in Table 2.

Table 2: Mean values and distribution of anthropometric indices, daily fluid intake and parents' knowledge on fluid consumption

Factor	Male (n=112)	Female (n=95)	Total
<i>Height (cm)</i>			
Mean ± SD	137.60 ± 13.90	135.93 ± 15.07	136.84 ± 14.43
<i>Weight (kg)</i>			
Mean ± SD	35.07 ± 11.16	33.21 ± 11.53	34.22 ± 11.34
<i>Body mass index (kg/m²)</i>			
Thinness	13 (11.6%)	09 (09.5%)	22 (10.6%)
Normal weight	68 (60.7%)	66 (69.5%)	134 (64.7%)
Overweight	22 (19.7%)	16 (16.8%)	38 (18.4%)
Obese	09 (08.0%)	04 (04.2%)	13 (06.3%)
Mean ± SD	18.32 ± 4.76	17.55 ± 3.52	17.97 ± 4.24
<i>Waist circumference (cm)</i>			
Normal	101 (90.2%)	82 (86.3%)	183 (88.4%)
Abdominal obesity	11 (09.8%)	13 (13.7%)	24 (11.6%)
Mean ± SD	62.30 ± 10.44	60.19 ± 9.37	61.33 ± 9.99
<i>Parents' knowledge on fluid consumption</i>			
Poor	89 (79.5%)	74 (77.9%)	163 (78.7%)
Good/Satisfactory	23 (20.5%)	21 (22.1%)	44 (21.3%)
Mean ± SD	8.88 ± 2.03	8.73 ± 2.22	8.81 ± 2.12

Boys had slightly higher anthropometric indices (height, weight, body mass index, waist circumference) compared to girls but the differences were not statistically significant (p>0.05). The mean score of parent's knowledge on fluid consumption was slightly higher among the boys compared to girls although no significant difference was found (p>0.05).

Majority (78.7%) of the parents had poor knowledge on fluid consumption.

Daily fluid intakes of the respondents are presented in Table 3. Parents' knowledge on fluid consumption according to hydration status is presented in Table 4.

Table 3: Daily fluid intake and hydration status of the respondents

Daily fluid intake (ml/day)	Male (n=112)	Female (n=95)	Total (n=207)
Water	870.18 ± 334.55	829.89 ± 339.92	851.69 ± 336.80
100% Fruit juice	122.86 ± 180.23	137.89 ± 173.95	129.76 ± 177.11
Sweetened juice beverage	41.70 ± 112.94	41.27 ± 87.25	41.50 ± 101.72
Whole milk	185.00 ± 165.55	149.79 ± 172.45	168.84 ± 169.25
Reduced fat milk	12.59 ± 47.30	16.11 ± 73.46	14.20 ± 60.60
Fat free milk	50.90 ± 118.95	30.42 ± 82.22	41.50 ± 103.98
Soft drinks	24.41 ± 73.67	38.53 ± 105.78	30.89 ± 89.89
Sweetened tea or coffee	20.89 ± 79.30	7.26 ± 31.61	14.64 ± 62.37
Tea or coffee with cream	20.98 ± 70.48	7.98 ± 42.47	15.05 ± 59.58
Energy & sports drinks	12.68 ± 45.00	15.47 ± 55.02	13.96 ± 49.74
Total fluid intake	1337.98 ± 556.14	1282.66 ± 540.32	1334.49 ± 549.71
Hydration status			
Sufficiently hydrated	24 (21.4%)	20 (21.1%)	44 (21.3%)
Insufficiently hydrated	88 (78.6%)	75 (78.9%)	163 (78.7%)

Table 4: Parents' knowledge on fluid consumption and hydration status of the children

Parent's knowledge	Hydration status		χ ²	p-value
	Sufficiently hydrated	Insufficiently hydrated		
Poor	18 (40.9%)	145 (89.0%)	47.788	<0.001
Good/Satisfactory	26 (59.1%)	18 (11.0%)		

A Chi-square analysis was conducted and significantly more parents had good knowledge on fluid consumption when the children were sufficiently hydrated (59.1%) compared to insufficiently hydrated (11%) ($\chi^2=47.788$; $p<0.001$).

The highest source of fluid intake came from water (851.69±336.80 ml/day) followed by whole milk (168.84±169.25 ml/day) and 100% fruit juice (129.76±177.11 ml/day). The least consumed beverages were sweetened tea (9.76±44.19 ml/day), regular coffee/tea

(4.88±38.39 ml/day) and diet soft drinks (2.13±15.37 ml/day). The mean of total fluid intake for the boys (1337.98±556.14 ml/day) was slightly higher than girls (1282.66±540.32 ml/day) although no significant difference was found ($p>0.05$).

In the bivariate analysis (Table 5), child's age ($r=0.276$, $p=0.000$) correlated with children's BMI. For daily fluid intake, only 100% fruit juice ($r= -0.149$; $p=0.032$) negatively correlated with children's BMI.

Table 5: Associations between socio-demographic factors, daily fluid intake and parent's knowledge on fluid consumption with BMI

Variables	Body Mass Index	
	t/F/r	p-value
<i>Socio-demographic factors</i>		
Age	0.276	0.000†
Gender	1.315	0.190
Ethnicity	1.708	0.184
Parents education	0.036	0.604
Household income	1.967	0.101
<i>Daily fluid intake</i>		
Water	-0.014	0.845
100% Fruit juice	-0.149	0.032†
Sweetened juice beverage	-0.010	0.887
Whole milk	-0.116	0.096
Reduced fat milk	-0.016	0.822
Fat free milk	0.065	0.354
Regular soft drinks	-0.012	0.862
Sweetened tea or coffee	-0.011	0.876
Tea or coffee with creamer	-0.057	0.418
Energy & sports drinks	-0.004	0.956
Total fluid intake	-0.105	0.133
Parents' knowledge on fluid intake	-1.799	0.073

*Significant association was determined by Independent T-test, $p<0.05$

†Significant association was determined by Pearson's correlation analysis, $p<0.05$

Hydration status and weight status are presented in Table 6. A chi-square analysis was conducted and significantly more overweight children

insufficiently hydrated (88.5%) compared to sufficiently hydrated ($\chi^2=9.065$; $p<0.05$).

Table 6: Hydration status and weight status of the children

Hydration status	Weight Status			χ^2	p-value
	Underweight	Normal	Overweight		
Sufficiently hydrated	7 (31.8)	39 (31.5)	7 (11.5)	9.065	0.011*
Insufficiently hydrated	15 (68.2)	85 (68.5)	54 (88.5)		

* Significant difference was determined at $p<0.05$

Discussion

The prevalence of overweight and obesity in this study (24.7%) was slightly higher compared to a large nutrition survey conducted among Malaysian children (21.6%)². The prevalence of overweight and obese children was higher among boys (27.6%) than girls (21%). This finding is consistent with past findings¹⁴ where the prevalence of obesity was higher among the boys than the girls.

In our study, majority (78.7%) of the parents had poor fluid consumption knowledge, whilst 21.3% had satisfactory and good fluid consumption knowledge. It was found that although no significant differences was observed in parents' fluid consumption knowledge with their children's weight status, the percentage of overweight and obese in children was found to be the highest in those parents with poor fluid consumption knowledge. This is supported by the study of Bar-David Y et al¹⁵ which stated that parents' fluid consumption knowledge was positively associated with children daily fluid intake and thus their hydration status.

Parents' fluid consumption knowledge was found to be associated with children's hydration status in the present study. Most of the children (74.4%) were not sufficiently hydrated if their parents had poor fluid consumption knowledge while for those parents with higher fluid consumption knowledge; most of their children were sufficiently hydrated. This finding can be supported by the study from Bar-David Y et al¹⁵ that found poor knowledge of children hydration requirement in parents will lead to an adverse effect of inadequate hydration in their children. Moreover, the knowledge on fluid consumption was found to be important to parents as the misunderstanding of the importance of fluid or the parents do not promote fluid intake would eventually cause the children to develop unhealthy drinking habits and thus consume inadequate amount of fluids throughout the day¹⁶.

Popkin BM, et al. suggested that the risk for school age children being overweight or obese could be reduced by 31% if they had good hydration status⁵. In our study, hydration status of the children was found to be associated with children's weight status. Furthermore, Armstrong LE, et al. suggested that water can reduce energy intake when it is consumed in place of sugar-sweetened beverages, juice, and

milk¹⁷. Children given sugar sweetened beverages (SSB) and non-caloric artificially sweetened drink showed that those consumed SSB had more weight gain and higher fat deposition after 18 months of the trial¹⁸. This could be explained as those given unsweetened beverages had similar satiety with those given SSBs. Hence, children are unlikely to substitute with eating more food among those given unsweetened beverage leading to lower body fat in comparison to the SSB group¹⁹.

There are some limitations in the present study. Firstly, the respondents were mainly Malay and Chinese in ethnicity with only two Indians so that Indians were under-represented. Secondly, participants were chosen only from one state in Malaysia and the findings may not apply to the whole population of children in Malaysia. Thirdly, recall bias may be possible as respondents might not remember fully the amount and frequency of the different types of fluid they consumed in the past week.

To our knowledge, this is the first study that examined the relationship between parents' knowledge on fluid consumption with hydration status and weight among Malaysian children. The findings from the present study highlight the importance of parents' fluid consumption knowledge in association with hydration status and weight status of the children. Parents with higher fluid consumption knowledge level were found to have children with better hydration status and weight status. Therefore, parents should be targeted to improve their knowledge and education on the importance of frequent fluid intake for the betterment of their children's health. In a nutshell, the relationship between BMI of children and parents' fluid consumption knowledge generated from self-composed questionnaire are not fully resolved. The need for further studies to investigate parents' fluid consumption knowledge is clear. The development of a more reliable and predictive as well as valid questionnaire for parents' fluid consumption knowledge is needed.

Conclusions

Parental fluid consumption knowledge was significantly associated with children's hydration status. Hydration status was significantly associated with children's BMI.

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