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Assessment of dietary intake among university students: 24-hour recall verses weighed record method

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ABSTRACT

The purpose of this study was to assess the dietary intake of University Putra Malaysia students using the weighed record method and the 24 hour-dietary recall method. The validity of the 24-hour recall method was studied by comparing it with the weighed record method. A total of 40 male and 25 female students age between 18-29 years volunteered to participate in this study. All the subjects were required to weigh and record the foods they ate for 1 day. Without prior knowledge of the purpose of the visit , the 24-hour recall was carried out the following day. The nutrients analysed were calorie, carbohydrates, protein, fat, calcium, iron, vitamin A and vitamin C. Comparisons of the nutrient intake between these two methods were determined. The paired *t-test* indicated no significant difference in group's mean nutrient intake between the weighed record method for all nutrients. The differences in group mean intake for all nutrients between weighed record and 24-hour recall method ranged from -3% to 3.6%. A total of 4 nutrients were underestimated, namely energy, protein, vitamin C and iron. The correlation coefficients showed a strong positive relationships between the two methods (ranged from $r = 0.88\text{-}0.98$, $p < 0.01$) for all of the nutrients analysed. In conclusion, the agreement between nutrient values from two different methods indicated that the 24 hour recall is a suitable method for the dietary assessment of university students.

INTRODUCTION

Many methods have been developed for the dietary assessment of individuals, such as dietary records, the 24-hour dietary recall, food frequency, diet history and weighed food record. All of these methods have their strengths and weaknesses (Thomson and Byers, 1994). The 24-hour dietary recall method is a widely used approach to collect dietary information because it is simple, impose little burden to the respondents and do not require high literacy in respondents. However,

numerous studies have reported that the individuals did not report their food consumption accurately during the 24-hour dietary recall for various reasons related to memory, interview situation or embarrassment. This resulted in the underestimation and overestimation of nutrient intake (Carter et al., 1981; Karvetti and Knuts, 1985; Robson,1995, Olinto 1994).

The weighed record method which can provide quantitatively accurate information on food consumed during the recording period, have been used by many researchers to validate the 24-hour dietary recall (Karvetti and Knuts,1985,Toh, Yap & Tan 1997, Bonifacj *et al* (1997)

Malaysian dishes which consist of mixture of ingredients as opposed to the less complicated mixture in the Western dishes brought some challenges to the 24-hour dietary recall method, a method widely used in assessing dietary intake in the community. Zamaliah (1995) reported a lower correlation coefficient between weighed record and 24-hour dietary recall method of complicated mixture in test meals compared to the simpler ones which is synonym to Western dishes. Due to the complexity of the Malaysian dishes it is therefore pertinent to validate the 24-hour dietary recall used in assessing Malaysian diet against the weighed record method which is regarded as the “gold standard”.

METHODS

Subjects

A total sample of 40 male and 25 female students aged between 18-29 years volunteered to participate in this study. These students are either residing in hostels provided by the university or staying off campus in the flats nearby. However , their meals are bought from the food stalls or prepared at home.

Dietary methods

Each subject was required to complete two different dietary assessments, namely, the weighed record method and the 24-hour dietary recall method. The weighed record was carried out by weighing the foods served and the plate waste and recorded in a form prepared by the investigator. The 24-hour dietary recall was conducted the day following the weighed record day without informing the subjects the purpose of the visit. The household measures were used to help the subjects recall the quantity of foods they had eaten.

The amounts of foods from the weighed record and the 24-hour dietary recall were converted to grams and the nutrient values computed using DIET 4 , a computerised version of the Nutrient Composition of Malaysian Foods (Tee et al., 1988).

Statistical analysis was carried out using the SPSS for Windows, version 8. Means and standard deviations were calculated for all nutrients and the paired-*t* test was

carried out evaluate the significance of the difference between the intakes reported by the weighed record and the 24-hour dietary recall method. Pearson correlation coefficients for 8 nutrients were computed.

RESULTS AND DISCUSSION

Dietary assessment

The nutrients analysed were energy, protein, fat, carbohydrates, vitamin A, vitamin C, calcium and iron. The paired *t*-tests revealed no significant difference (indicating the validity of the 24 –hour recall) between the group's mean intake for all nutrients (Table 1). All of the subjects remembered what they ate the day before and could also reasonably quantify it. The use of standard measuring cups and spoons had been useful to the subjects.

Table 1 shows the mean nutrient values for the two methods.. The nutrient values calculated for 24-hour dietary recall and weighed record were very close. However, under-reporting and over-reporting of nutrient intake was shown in this study. Compared to the weighed record, the 24 hour recall reported a significantly lower amounts of energy, protein, vitamin C and iron and higher amounts of fat, carbohydrate, vitamin A, and calcium.The underreporting of estimates of energy intake was also reported by Zamaliah, 1995 except that in this study life size photographs were used to aid in the recall.

The differences between mean recalled and weighed record nutrient intake ranged from –3% to 3.6%. The nutrient that has the lowest mean difference was iron (0.7%) and the largest overestimate was from calcium (3.6%). A mean difference of 10% or less has been used as an indicator of a good agreement between measures. In this study the agreement

Table 1 : Differences in mean weighed record and recalled intake of selected nutrients

Nutrients	Weighed Record Method (Mean±s.d)	Recalled Method (Mean± s.d)	% [a] Difference	P Values
Energy (kcal)	1215 ± 460	1230 ± 442	-1	0.52
Protein (g)	47.0 ± 20.7	46.5 ± 17.9	-1	0.67
Fat (g)	35.08± 17.8	36.3 ± 17.2	3	0.25
Carbohydrate (g)	177.6±78	179.8 ± 77.7	1	0.56
Vitamin A (μg)	707.7±494.2	718.4 ± 508.6	1.5	0.53
Vitamin C (mg)	30.95± 47.8	30.1 ± 45.0	-3	0.51
Calcium (mg)	233.49±175.0	241.8 ± 179.8	3.6	0.25
Iron (mg)	15.2± 12.7	15.1 ± 12.2	-0.7	0.89

[a]100 x (recalled-weighed record)/weighed record
*p<0.01

between the two measures were very close whereby the difference between the recalled mean intake and the weighed record intake for all nutrients was less than 10%. The agreement between nutrient values from two different methods was closer than reported in a previous study in which life size photographs of foods were used (Zamaliah, 1995). As in Robson (1995) the differences at group level between the two different methods were insignificant but errors were noted at individual level. Table 2 shows the distribution of relative error of recalled nutrients in relation to weighed record intake in the subjects. An error of, at the most, 20% in either direction was found for more than half of the subjects for all of the nutrients.

The Pearson correlation coefficient showed a significant strong positive relationships between the 24-hour dietary recall and the weighed record method for all nutrients at $p<0.01$ (Table 3). Correlations between recalled and weighed record values ranged from 0.88 for protein and 0.98 for vitamin C. These results are in agreement with the results of Toh *et al* (1997), while another validation study among adults showed a much lower correlation (Karvetti ,1985).

Table 2: Distribution of relative error of recalled nutrients

Nutrients	Underestimate>20% (% subject)	Error $\pm$ 20% (% subject)	Overestimate >20% (%subject)
Energy	6.2	78.5	15.4
Carbohydrate	9.2	73.8	16.9
Protein	10.8	75.4	13.8
Fat	7.7	67.7	24.6
Calcium	3.1	87.7	9.2
Iron	10.9	73.4	15.6
Vitamin A	15.6	66.2	16.9
Vitamin C	19.2	59.0	21.3

Table 3 : Correlation coefficients of nutrient intake by 24-hour dietary recall and weighed record method

Nutrients	r	p
Energy (kcal)	0.92	0.00 **
Protein (g)	0.88	0.00 **
Fat (g)	0.89	0.00 **
Carbohydrate (g)	0.92	0.00 **
Vitamin A/RE (µg)	0.97	0.00 **
Vitamin C(mg)	0.98	0.00 **
Calcium (mg)	0.95	0.00 **
Iron (mg)	0.89	0.00 **

CONCLUSION

This study shows that the 24 hour dietary recall is a reliable method of assessing nutrient intake particularly among young adults of this age group. The results obtained were very encouraging with highly significant correlation coefficients between recalled and weighed record nutrient intake and no significant differences between the nutrient intake of all nutrients between the 2 different methods, which indicated the validity of the 24-hour dietary recall method.

Compared to previous studies the results of this study showed a stronger correlation between the 24-hour dietary recall and the weighed record method with a correlation coefficients ranging from $r=0.88$ to $r=0.98$ at $p<0.01$. Zamaliah (1995) showed a high correlation between the two methods for simple test meals, but a more complicated test meals as found in the diet of these subjects showed a weaker correlation.

Although the 24-hour dietary recall showed a certain degree of accuracy in the dietary assessment of young adults, it may be less accurate for younger age group as reported by Leslie et al (1998) in their study among children of fourth grade which revealed a lower correlation between observed and recalled intake ranging from 0.37 to 0.65, of which only 60% of the nutrients had high correlation between observed and recalled values. Young children who are not familiar with portion sizes and the elderly who experience memory decline need other tools such as photographs and other visual aids to help them quantify their recalled food intake, thus improve accuracy of recall.

In conclusion, even though the results in this study showed a high degree of validity, it is presumptious to say this is the best method for young adults since the validity was based on 1 day weighed record and diet recall. The small sample size and the biases of the sampling technique, which was based on volunteers, might have influenced the results. A multiple 24-hour diet recall and weighed record conducted at different periods may yield more reliable results. Comparisons between 24-hour dietary recall with other dietary assessment methods should also be considered.

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