

Short Communication

Use of Red Palm Oil in Local Snacks Can Increase Intake of Provitamin A Carotenoids in Young Aborigines Children: A Malaysian Experience

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ABSTRACT

Introduction: Carotenoid-rich red palm oil (RPO)-based snacks have been provided to children in impoverished communities to improve their vitamin A status. The non-availability of information on the acceptability of RPO-based snacks by Malaysian aborigines (*Orang Asli*) children forms the basis of this study. **Methods:** Twenty-one *Orang Asli* children, majority of whom had normal body mass index for age (BMI-for-age) and aged 4.73 ± 0.92 years in Sungai Tekir, Negeri Sembilan were provided with three freshly-prepared snacks (springroll, curry puff or doughnut) each containing one teaspoon or 5 ml of RPO per serving, on separate mornings. On the fourth morning, one serving each of all 3 different snacks was provided together on a plate to every child for consumption and preference for the snacks recorded. The children's habitual vitamin A intakes were assessed by a semi-quantitative food frequency questionnaire (FFQ) and carotenoid retention tests for the prepared snacks were performed by column chromatography. **Results:** Fifty-four percent of the children did not meet their RNI for vitamin A. Based on acceptance criterion of consuming at least one-half serving of the snacks provided, springroll and curry puff recorded 100% acceptability while doughnut had 82% acceptability. Preference of snack was in the order, springroll (47%) > doughnut (35%) > curry puff (18%), but a Z-test test for proportions showed no statistical significance. Carotenoid retention tests showed great variation between snacks namely, doughnut (100%) > springroll (84%) > curry puff (45%). **Conclusion:** The overall findings indicate that the RPO-based snacks are highly acceptable and can be used to improve the dietary intake of provitamin A carotenoids of Malaysian *Orang Asli* children.

Keywords: Red palm oil snacks, carotenoids, acceptability, *Orang Asli* children

INTRODUCTION

In Malaysia, vitamin A deficiency (VAD) has been reported to be a sub-clinical problem amongst two rural communities in the

Peninsula (Ng & Chong, 1977). Much later, however, Nor Ngah *et al.* (2002) reported an alarmingly high rate of ocular manifestation of VAD among *Orang Asli* children in a settlement in Peninsular Malaysia. It is

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uncertain whether this problem is more widespread amongst *Orang Asli* communities in Malaysia compared to children of other communities.

Red palm oil (RPO) contains about 500 ppm carotenoids, one-half of which is contributed by beta-carotene and one-quarter by alpha-carotene (Carotino Group, 2011). RPO carotenoids are highly bioavailable in humans (You et al., 2002) and are used in local snacks to combat VAD in impoverished communities particularly in India (Rukimini, 1994) and Africa (van Stuijvenberg et al., 2000).

The present study investigates the acceptability and order of preference by a group of Malaysian *Orang Asli* children for three different local snacks (springroll, curry puff and doughnut) made from recipes developed by the research team. To the best of our knowledge, this study represents the first of its kind in Malaysia.

Permission was obtained from the National *Orang Asli* Department to conduct the present study in the Sungai Tekir village, Labu, Negeri Sembilan. This research study was approved by the Joint Research and Ethics Committee of the International Medical University (IMU), Kuala Lumpur.

METHODS

The target *Orang Asli* children

Twenty-six *Orang Asli* children (9 males, 17 females, mean±SD for age= 4.73 ± 0.92 years)

were recruited from a total pool of 35 children from two kindergartens in Sungai Tekir. However, on commencement of the project, only 21 of the children participated in the consumption of the snacks prepared. The children were measured for weight (SECA balance) and height (microtoise tape) and their body mass index (BMI)-for-age was classified according to the World Health Organisation growth charts (WHO, 2006).

RPO used

The carotenoid composition of the premium RPO used is shown in Table 1. One teaspoon (5g) of the RPO is estimated to provide about 270 µg retinol equivalents (RE), which is about 60% the recommended nutrient intake (RNI) for vitamin A of 450 RE in Malaysian children (NCCFNM, 2005).

Snacks prepared

RPO was incorporated into three different popular local snacks - a curry puff, doughnut, and springroll. The recipes for these three snacks are shown in Table 2 and their pictures in Figure 1.

The snacks had to be prepared in the Nutrition and Dietetics Laboratory at IMU between 6.00-7.30 am of each of the selected days of feeding, and then sent immediately to the study village situated some 80 km from the IMU campus. The RPO-snacks arrived at Sungai Tekir village around 8.45 am and were provided as a morning snack around 9.30 am.

Table 1. Composition of RPO*

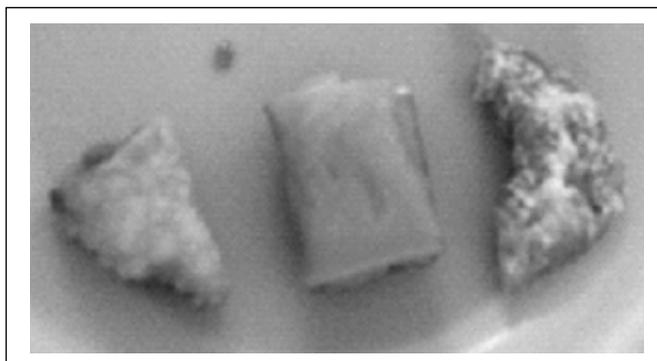
Carotenoids	Amount per 5 ml RPO (mg)	Percentage (%)
β-carotene	1.10	47
α-carotene	0.87	37
Other carotenes	0.37	16
Total carotenes	2.33	
Approx. RE**	270	

* Adapted from Carotino Group (2011).

** 1 retinol equivalent (RE) = 6 µg β-carotene or 12 µg α-carotene/other provitamin A carotenoids (FAO/WHO, 2002).

Table 2. Ingredients of the three RPO-based snacks

<i>Springroll</i>		<i>Doughnut</i>		<i>Curry puff</i>	
<i>Ingredient</i>	<i>Quantity/ serving</i>	<i>Ingredients</i>	<i>Quantity/ serving</i>	<i>Ingredients</i>	<i>Quantity/ serving</i>
Edible wrapper	1 sheet	<u>Dough:</u>		Tapioca	13 g
Small prawn	3	Plain flour	60 g	Flour	6.5 g
Minced meat	3	Margarine Ice- water	½ teaspoon 3 ml	Sugar	4 g
Yam bean, peeled, boiled	5	<u>Fillings:</u>			
Omelette egg, shredded	3	Sweet potato	3 g		
Lettuce leaf	1 small	Potato	3 g		
Garlic	1 clove	Red onion, chopped	A pinch		
RPO	5 ml	Curry powder	½ teaspoon		
Salt, pepper & sugar added to taste	√	Chilli powder	½ teaspoon	RPO	5 ml
		RPO	5 ml		

**Figure 1.** Half of the three different RPO-based snacks

Acceptance of RPO snacks

The study children were provided with one serving of each type of RPO-snack on three different mornings. One serving = 1 springroll or 1 curry puff or 1 doughnut. Acceptance of a snack was set at consuming at least one-half serving of the snack served. On a fourth morning, one-serving each of all three different snacks were provided to each child for consumption and the child's preference for the snacks recorded.

Carotenoid retention

The carotenoid content of the RPO-snacks before and after baking/frying was determined in duplicate by column chromatography with quantitation by spectrophotometry at 440nm. No carotene standard was used. Instead, the absorbance at 440 nm of the hexane extracts of similar amounts of homogenised prepared snack versus that of the 'raw' snack was compared and the carotenoid in the RPO retained after

baking/frying was calculated as a percentage.

Vitamin A intakes

The habitual vitamin A intake of the children was determined using a semi-quantitative FFQ by interviewing the parents concerned with the aid of a village translator. Daily amounts of food items consumed were converted into grams and macronutrients and vitamin A was estimated by the nutrient calculator-DietPLUs (Ng, 2010). The supplemental vitamin A values with the introduction of the RPO-based snacks could then be estimated.

Statistical analysis

Statistical analysis was done using SPSS Version 18. Acceptability and preference for the snacks were analysed using the Z-test for proportions (dependent groups) at 95% confidence interval (McCallum, 2010).

RESULTS

Anthropometric measurements of the 26 *Orang Asli* children showed that 80% of them had normal BMI-for-age while 20% suffered from 'thinness' (WHO, 2006). Their mean daily intake of vitamin A was 606 ± 332 RE and 54% of the children did not meet their RNI requirements for vitamin A of 450 RE. The 5 ml of RPO in each serving of snack provided 270 RE and this would have corrected the inadequate dietary vitamin A intake in the children concerned.

All three snacks were highly acceptable - springroll (100%), curry puff (100%) and doughnut (82%). The preference for the three RPO snacks by the young subjects is in the order: springroll (47%)>currypuff (35%)>doughnut (18%). Statistical analysis by the Z-test for proportions at 95% confidence interval showed no statistical significance between snack types either for acceptability or preference.

The carotenoid retention tests performed showed the order: doughnut (100%)>springroll (84%)>curry puff (45%). This variation is expected as the three snacks were subjected to different heating conditions during preparation.

DISCUSSION

The research team faced three-fold challenges in the production of three different types of RPO-based snacks. First, the RPO-based snacks needed to be acceptable in taste and appearance by the intended target children. Second, the method of preparation of the snacks must allow for substantial retention of the original provitamin A carotenoids in the RPO used. Third, 5 ml of RPO was incorporated into each serving of the snack prepared.

About 20% of the child subjects suffered 'thinness' based on BMI-for-age and 46% of all subjects did not meet their RNI for vitamin A of 450 RE. The RPO snacks, after allowing for carotenoid retention, would have provided 130- 270 RE per serving. These amounts would elevate substantially the dietary vitamin A intakes of the *Orang Asli* children in the study and underscore this important potential role of RPO in the whole *Orang Asli* community as well.

The cost of producing each type of snack varied considerably with springroll having the highest cost and curry puff the lowest (cost figures not shown). Since acceptability of the three snacks was very high (82%-100%), then the preparation of curry puff would have a slight advantage over that of springroll if cost of production needs to be standardised across snack types.

Carotenoids are easily destroyed by light, oxidation and elevated temperatures and therefore, it is not surprising to note that there was a 16% destruction of RPO carotenoids in the springroll snack and 55% destruction in the curry puff product. This agrees somewhat with the 20-30% destruction reported for provitamin A

carotenoids when carotenoid-rich crude palm oil was incorporated into foods that were baked and shallow or deep-fried (Nestel & Nalubola, 2003).

CONCLUSION

The overall findings of the study indicate that the incorporation of RPO into the three local snacks selected was highly acceptable to the *Orang Asli* children who participated. Springroll was the most preferred snack with doughnut being the least.

The RPO snacks can be used to increase provitamin A intakes of Malaysian *Orang Asli* children. Extreme cooking conditions should be avoided to preserve the carotenoid content of RPO.

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