

*Full Length Research paper*

# Nutritive value and sensory evaluation of airline snacks

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Accepted March 18, 2010

This study was conducted to assess the nutritive value of Libyan Airline Snacks in comparison with (Recommended Dietary Allowances) RDA and to conduct sensory evaluation of selected snacks on board the flights. Food samples collected from the catering department of Benina International Airport, Benghazi, Libya for a period of two months. For sensory evaluation of selected snacks, a self administered questionnaire prepared on the basis of the Hedonic scale was distributed by the cabin crew to the passengers traveling on flights from Benghazi to Cairo. Hundred passengers participated in the study. The results on nutritive value of snacks revealed higher amounts of energy, carbohydrates, saturated fat and sodium in comparison with the RDA in most of the snacks. Whereas, the micronutrient content with respect to vitamins, viz., A, E, B vitamins, iron and calcium did not meet the RDA with respect to most of the snacks. Sensory evaluation of snack items revealed that a majority of the travelers disliked slightly or moderately most of the food items except croissant chocolate served as snack. Hence the Airline needs to seriously look into this issue and improve the micronutrient content of snacks, simultaneously reducing the total energy and sodium content, and replacing saturated fat present in the snacks in the best interests of preventing health risks to regular airline passengers. Also the choice of menus and palatability of dishes served in flights needs immediate review.

**Key words:** Airline meal, nutritive value, RDA comparison, sensory characteristics, traveler evaluation.

## INTRODUCTION

Airline meals are an essential part of the travel industry. In the late 1920s, the early days of air travel, the food was virtually cooked in the air and passengers sat at dining tables to eat. As the volume of air traffic increased, much food was premade, plated and kept warm and only served on the plane. Long haul flights always include a meal or meals every three hours, mimicking rhythms of normal eating breakfast – snack – lunch – snack – dinner – snack ([www.articleworld.org/index.php/airline-meal](http://www.articleworld.org/index.php/airline-meal)).

The nutritional value of food served on airline varies depending on what the meal is and where you are in the world. However, airline food is very rich in energy, fat and salt contents than recommended (Grammatikopoulou et al., 2007). Energy requirements of airline passengers are lower compared to normal everyday life, since the passengers remain seated throughout the journey. A recent survey conducted on a U.S carrier showed that an airline meal provides 950 calories, which is almost half of the average of an adult women's requirement by the Recommended Dietary Allowances. Also the fat content was

nearly 50 g of which half was saturated fat (Food and Nutrition Board, 2004; Grammatikopoulou et al., 2007).

Some nutrients, for example vitamin C and B<sub>12</sub> which are found in fruit salads are quite prone to being lost over a period of time or during heating. Thus, storing food in the refrigerator or adding an antioxidant compound to the food can reduce loss of these constituents (CNN, 2005).

Due to the high energy, fat and salt content of airline food, airline caterers should aim at providing balanced low energy, low fat, low fiber and low salt diets while flying. This means a diet based on starchy carbohydrates such as breads, potatoes, pasta or rice combined with a good supply of fruits, vegetables and some protein either from fish or meat or a vegetarian source would be ideal. Also provision of enough drinking water and fruit juice to stay hydrated on the flight is important (CNN, 2005).

Meals have generally declined in quality since the 1980s, as many seasoned travelers commented that today's first class meals are reminiscent of coach class meals of the 1980's ([www.articleworld.org/index.php/airline-meal](http://www.articleworld.org/index.php/airline-meal)). Also variety in airline food is influenced by class in which the customer is traveling (Karen, 2008).

Meals must generally be frozen and heated on the ground before takeoff rather than prepared fresh which

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may probably have an effect on the taste and flavor. It has also been suggested that the taste buds are less sensitive at higher altitudes making everything taste bland. However, most airline meals are designed bland because of two factors— food safety and passenger comfort. In addition to maintaining high levels of hygiene and food safety, airline caterers must prepare meals that will taste good at 10000 m and on being reheated six hours after preparation and freezing ([www.articleworld.org/index.php/airline-meal](http://www.articleworld.org/index.php/airline-meal)). The Hedonic Scale (ASTM, 1968), which is a nine point scale can be of significant use to measure traveler satisfaction with respect to sensory characteristics such as taste, smell, colour and overall acceptability of the food items served.

In the above context, it was thought to be of interest to study snack types served by Libyan airlines, the nutritive value of selected snacks in comparison with the RDA and to evaluate the sensory characteristics of airline snacks using the Hedonic scale.

## MATERIALS AND METHODS

For this study, the Libyan Airline located at Benina International Airport was selected. Random samples of different types of snacks prepared by the Libyan airline catering department were selected in triplicate to study the nutritive value.

The whole snack was weighed and the chef was consulted regarding the amount of the different ingredients used in the portion of snack served per passenger fee and juice were measured using measuring cups. After estimating the amount of the different ingredients in the snack, the food composition tables (Smolin and Grosvenor, 2003) were used to calculate the nutritive value.

The nutritive value was calculated separately for each of the different snacks and compared with "Recommended Dietary Allowances for the age group 31 - 50 years (Food and Nutrition Board, 2004), under assumption that a majority of the travelers usually belong to this age group. For comparison of energy content of the selected food items, the estimated energy requirement (EER) equation for age group 31 - 50 years was used to calculate the average energy requirement of the travelers. Also the fat and saturated fat content considered respectively as 30 and 7% of the energy requirements and carbohydrates and proteins as 50 - 60% and 10- 20% of the energy requirements were used as the standard for comparison according to the NCEP guidelines (Food and Nutrition Board, 2004).

A sensory evaluation study with respect to taste, smell, colour and overall acceptability was designed to evaluate the sensory characteristics of selected snacks served by Libyan Airlines and tested by customers traveling from Benghazi to Cairo. This evaluation was dealt using a structured self administered questionnaire according to the Hedonic Scale (ASTM, 1968) - which is a nine point scale (like extremely, like very much, like moderately, like slightly, neither like nor dislike, dislike slightly, dislike moderately, dislike very much, dislike extremely) used to assess the sensory characteristics of snack items served in the Libyan airlines aircraft. One hundred and twenty questionnaires were distributed randomly to passengers traveling from Benghazi to Cairo by the cabin crew and forwarded to the Benghazi airport authorities for collection. One hundred passengers cooperated and participated in the study and returned the filled up questionnaires. Only the snacks served on this particular flight were evaluated. Hence, the data on sensory evaluation of snacks such as sambusk and kabba for which nutritive value was estimated could not be obtained.

The collected data and the correlation between sensory characteristics (taste, smell and colour) and overall acceptability of food items served as snacks were analyzed by Pearson's correlation using SPSS software.

## RESULTS AND DISCUSSION

The nutritive value of food items served as snacks which were either sambusk (a snack prepared using refined flour, egg and cheese fried in oil), kabba (a snack using meat, onion and spices fried in oil after coating with egg and rusk) or croissant chocolate along with cake, tea and fruit juice are presented in Tables 1, 2 and 3 in comparison with the RDA.

The evaluation of the nutrient content of snack (I) (Table 1) which consisted of sambusk, cake, coffee and fruit juice, showed that energy, fibre, fat, saturated fat, thiamin and riboflavin were less than 20% of the RDA for both sexes. Other nutrients such as protein, calcium, sodium, vitamin A and E, niacin, vitamin B6 and folic acid were less than 10% of RDA for both sexes. All these macro and micronutrients were less than the RDA requirements for snack items which are expected to have at least 20% of the day's RDA.

The vitamin C content was between 87 - 104% of RDA for both sexes, followed by carbohydrate which met 42% of the RDA of both sexes. Both exceeded the RDA requirements of snack items (20%).

Snack II nutrient content estimation (Table 2) consisted of kabba, cake, coffee and juice showed that vitamin B<sub>12</sub> content was 150% of the RDA, followed by vitamin C content with 87 - 104% of the RDA for both sexes. Protein content was 64 - 78% of the RDA, whereas, nutrients such as niacin and riboflavin were 40 - 65% of the RDA.

Energy, carbohydrates and saturated fat were 20 - 36% of RDA for both sexes. Many macro and micro nutrients such as total fat, fiber, calcium, vitamins A and E were less than 12% of RDA for both sexes and thiamine, vitamin B<sub>6</sub> and folic acid were less than 20% of the RDA and did not meet the RDA requirements for snack items. Saturated fat was 72% of the total fat content of snack (II).

Snack III macronutrient appreciation showed that (Table 3), total fat (34 - 54% RDA), saturated fat (74 - 120% RDA), carbohydrates (62% RDA) and energy (25 - 40% RDA) exceeded the RDA snack requirement, whereas, protein (with respect to adult man) and fibre (with respect to both sexes) were less than the RDA snacks requirement. The saturated fat was 53% of total fat content of snack (III).

Vitamin C content was 75 - 120% of the RDA for both sexes. Nutrients such as sodium, thiamine and riboflavin were 30 - 40% of the RDA for both sexes, thus exceeding the requirement. Calcium, vitamins E, B<sub>6</sub>, B<sub>12</sub> and folic acid were less than the RDA requirement for snack items.

Sensory evaluation of selected items was performed by

**Table 1.** Nutritive value of sambusk with other tea items (Snack I) served by Libyan airlines in comparison with RDA.

% of RDA met by sambusk with other tea items (Snack I)		Nutritive value of sambusk with other tea items (Snack I)	Nutrients
%RDA of ** adult woman	%RDA of* adult man		
16 - 19 (a)	12 - 18 (a)	290	Energy(Kcal)
42	42	54.4	Carbohydrate(g)
8	7	3.9	Protein(g)
12	8	2.9	Fiber(g)
12 - 15 (b)	9 - 14 (b)	7.3	Total Fat(g)
12 - 14 (c)	9 - 14 (c)	1.7	Saturated (g)
7	7	65.3	Calcium(mg)
11	24	1.9	Iron(mg)
6	6	86	Sodium(mg)
1.2	1	8.4	Vitamin A(ug)
104	87	78	Vitamin C (mg)
5	5	0.8	Vitamin E (mg)
14	13	0.15	Thiamine (mg)
15	12	0.16	Riboflavin (mg)
11	9	1.5	Niacin (mg)
8	8	0.11	Vitamin B6(mg)
-	-	-	Vitamin B12(ug)

\* RDA for adult man aged 31-50 years was considered for comparison of the nutritive value of snack I .Value presented represent percentage of RDA of adult man met by snack I.

\*\* RDA for adult woman aged 31-50 years was considered for comparison of the nutritive value of snack I . Values presented represent percentage of RDA of adult woman met by snack I.

(a) Has been computed based on EER for ages 31- 50 years with reference BMI.

(b) and (c) have been computed based on NCEP guidelines .

**Table 2.** Nutritive value of kabba with other tea items (Snack II) served by Libyan airlines in comparison with RDA.

% of RDA met by Kabba with other tea items (snack II)		Nutritive value of Kabba with other tea items (Snack II)	Nutrients
%RDA of ** adult woman	%RDA of * adult man		
26 - 31 (a)	20 - 29 (a)	469	Energy(Kcal)
36	36	46	Carbohydrate(g)
78	64	35.8	Protein(g)
7	5	1.74	Fiber(g)
10 - 12 (b)	8 - 11 (b)	6	Total Fat(g)
31 - 36 (c)	23 - 36(c)	4.3	Saturated (g)
5	5	65.3	Calcium(mg)
23	51	4.1	Iron(mg)
25	25	148	Sodium(mg)
0.3	0.3	2.4	Vitamin A(ug)
104	87	78	Vitamin C (mg)
6	6	0.96	Vitamin E (mg)
19	18	0.21	Thiamine (mg)
48	41	0.53	Riboflavin (mg)
62	54	8.6	Niacin (mg)
13	13	0.17	Vitamin B <sub>6</sub> (mg)
150	150	3.6	Vitamin B <sub>12</sub> (ug)
15	15	59	Folic acid (ug)

\* RDA for adult man aged 31 - 50 years was considered for comparison of the nutritive value of snack II. Values presented represent percentage of RDA of adult man met by snack II.

\*\* RDA for adult woman aged 31-50 years was considered for comparison of the nutritive value of breakfast . Values presented represent percentage of RDA of adult women met by snack II.

(a) Has been computed based on EER for ages 31 - 50 years with reference BMI.

(b) and (c) have been computed based on NCEP guidelines .

**Table 3.** Nutritive value of croissant chocolate with other tea items (Snack III) served by Libyan airlines in comparison with RDA.

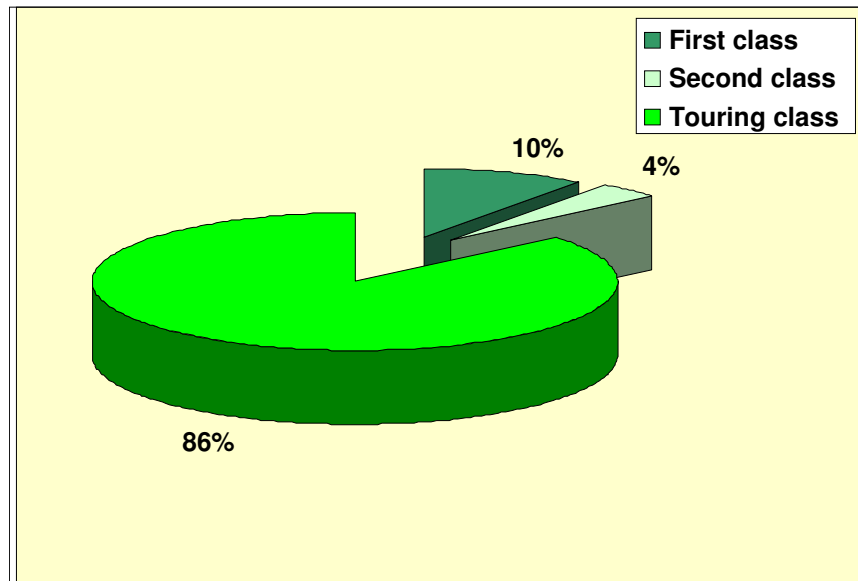
% of RDA met by croissant chocolate with other tea items (Snack III)		Nutritive value of croissant chocolate with other tea items (Snack III)	Nutrients
%RDA of** adult woman	%RDA of* adult man		
33 - 40 (a)	25 - 37(a)	594	Energy(Kcal)
62	62	80.9	Carbohydrate(g)
21	17	9.5	Protein(g)
15	10	3.7	Fiber(g)
45 - 54 (b)	34 - 51 (b)	27.2	Total Fat(g)
120 - 119 (c)	75 - 119 (c)	14.3	Saturated (g)
10	10	99	Calcium(mg)
22	50	4	Iron(mg)
32	32	477	Sodium(mg)
25	19	174	Vitamin A(ug)
104	87	78	Vitamin C (mg)
1	1	0.14	Vitamin E (mg)
36	33	0.4	Thiamine (mg)
39	33	0.43	Riboflavin (mg)
27	24	3.8	Niacin (mg)
7	7	0.09	Vitamin B <sub>6</sub> (mg)
7	7	0.16	Vitamin B <sub>12</sub> (ug)
16	16	62	Folic acid (ug)

\* RDA for adult man aged 31-50 years was considered for comparison of the nutritive value of snack III. Values presented represent percentage of RDA of adult man met by snack III.

\*\* RDA for adult woman aged 31-50 years was considered for comparison of the nutritive value of breakfast . Values presented represent percentage of RDA of adult woman met by snack III.

(a) has been computed based on EER for ages 31- 50 years with reference BMI .

(b) and (c) have been computed based on NCEP guidelines.



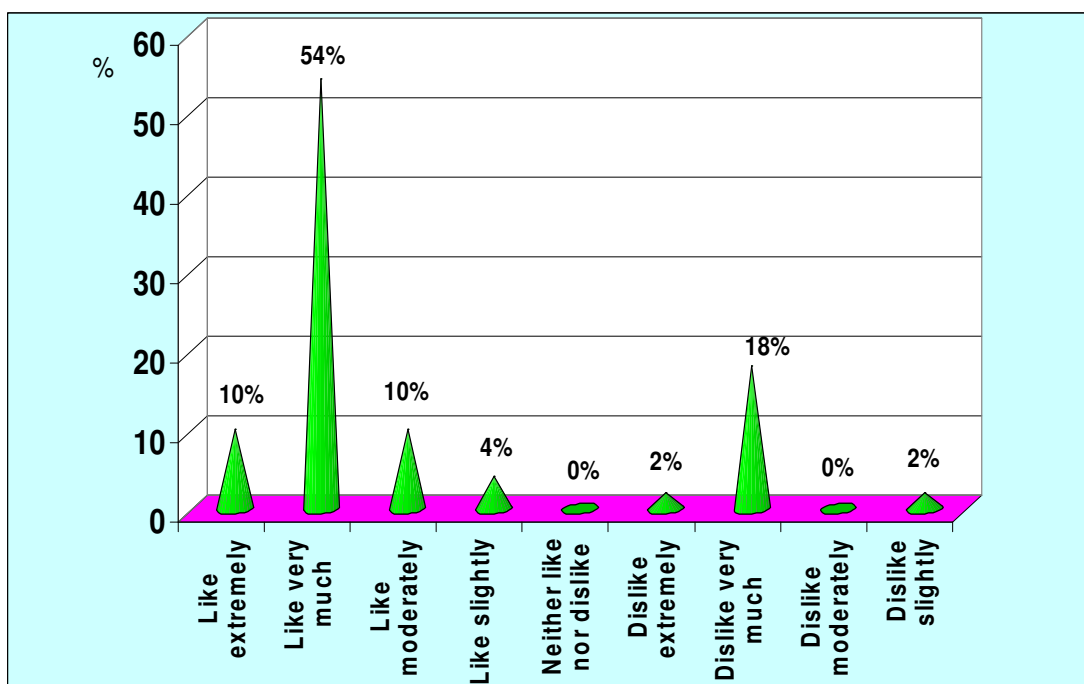
**Figure 1.** Distribution of travelers undergoing sensory evaluation of snack items according to type of traveling class.

travelers on board the Benghazi Cairo flight. The travelers who evaluated the snack items were distributed

according to the type of traveling class and the data is presented in Figure 1.

**Table 4.** Distribution of travelers according to sensory evaluation of snack items (croissant).

	Snack items (croissant )		
	Taste	Smell	colour
	% of passengers	% of passengers	% of passengers
Like extremely	34	36	38
Like very much	18	16	18
Like moderately	14	22	16
Like slightly	12	4	6
Neither like nor dislike	10	6	2
Dislike slightly	2	0	0
Dislike moderately	2	4	4
Dislike very much	6	2	4
Dislike extremely	2	10	12
Total	100	100	100

**Figure 2.** Distribution of travelers according to overall acceptance of snack items (croissant).

The majority of travelers who participated in the sensory evaluation of snack items (Figure 1) traveled in the touring class (86%), whereas, only ten and four percent traveled in the first and second class, respectively. The duration of travel was 1 h.

Table 4 and Figure 2 depict the distribution of travelers according to sensory evaluation of croissant served as snack.

Most of the travelers extremely liked the taste (34%), smell (36%) and colour (38%) of croissant with chocolate (Table 4 and Figure 2). With respect to overall acceptability of the product, 54% liked it very much. Only 2% either slightly or extremely disliked the product. Table

5 depicts the distribution of travelers according to their opinion about coffee served along with snacks.

Majority of the travelers extremely disliked the taste (42%), smell (38%) and colour (40%) of coffee (Table 5) served along with snack items. With respect to overall acceptability 60% expressed that they disliked coffee very much.

Table 6 depicts data related to sensory evaluation of juice served along with snack items. Results showed that the majority of travelers (Table 6) extremely disliked the taste (32%), smell (28%) and colour (26%) of juice served with snack items. With respect to overall acceptability, 46% stated that they disliked the overall

**Table 5.** Distribution of travelers according to sensory evaluation of snack items (coffee).

Opinion	Snack items (coffee )			
	Taste	Smell		Over all acceptance
	% of passengers	% of passengers	% of passengers	% of passengers
Like extremely	0	0	0	0
Like very much	0	0	0	4
Like moderately	0	0	4	0
Like slightly	4	4	0	0
Neither like nor dislike	6	8	6	0
Dislike slightly	8	4	6	4
Dislike moderately	24	26	20	20
Dislike very much	16	20	24	60
Dislike extremely	42	38	40	12
Total	100	100	100	100

**Table 6.** Distribution of travelers according to sensory evaluation of snack items (Juice).

Opinion	Snack items (Juice )			
	Taste	Smell	Colour	Over all acceptance
	% of passengers	% of passengers	% of passengers	% of passengers
Like extremely	4	4	4	2
Like very much	2	4	2	6
Like moderately	2	0	2	0
Like slightly	2	2	2	2
Neither like nor dislike	8	8	6	0
Dislike slightly	16	12	12	10
Dislike moderately	26	28	24	26
Dislike very much	8	14	22	46
Dislike extremely	32	28	26	8
Total	100	100	100	100

overall product very much. Only 2% of the travelers expressed that they extremely liked the overall product.

Table 7 and Figure 3 represent distribution of travelers according to sensory evaluation of cola served along with snacks.

Majority of the passengers (Table 7 and Figure 3) extremely liked the taste (30%), smell (30%) and colour (32%) of cola. With respect to overall acceptability, 32% liked cola very much. Only 2% of the passengers extremely disliked the overall product.

The correlation data correlation between sensory characteristics (taste, smell and colour) and overall acceptability of food items served as snacks is presented in Table 8.

The results showed that a significant correlation (Table 8) existed between sensory characteristics (taste, smell and colour) and overall acceptability of snack items such

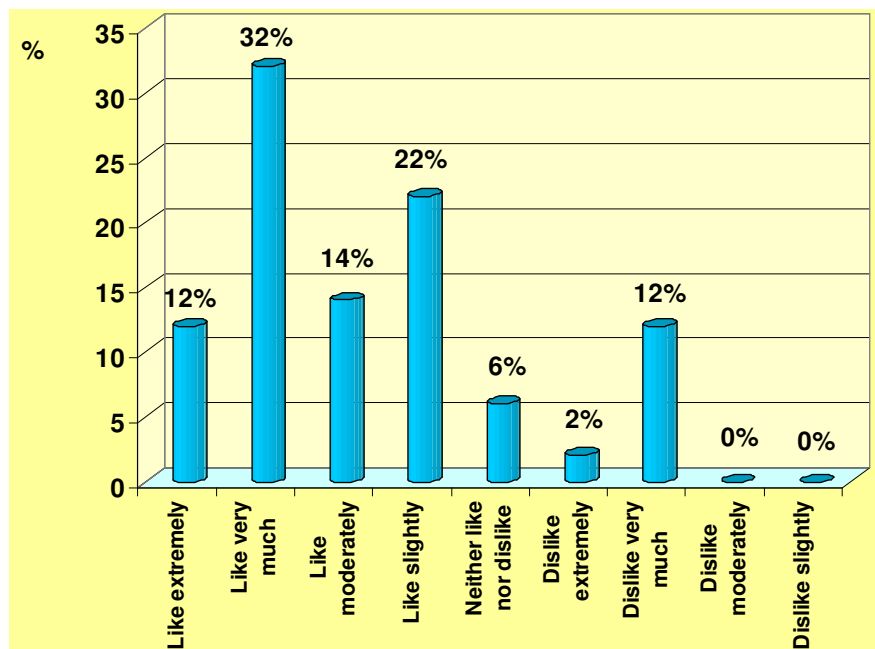
as croissant, coffee, juice and cola.

## DISCUSSION

With respect to snack I, nutrients such as protein, fiber, calcium, iron, vitamins A, E, thiamine, riboflavin, niacin, vitamin B<sub>6</sub> and folic acid met less than 20% of the RDA of adults. Vitamin B<sub>12</sub> was totally absent in snack I. In snack II, fiber, calcium, vitamins A, E, thiamine, B<sub>6</sub> and folic acid met less than 20% of the RDA of adults. In snack III, protein, fiber, calcium, vitamins A, E, B<sub>6</sub>, B<sub>12</sub> and folic acid met less than 20% of the RDA. These results highlight the importance of including snacks rich in protein, fiber, calcium, iron, vitamins A, E and B complex in the snacks, since such nutritious snacks are highly essential for the health of the travelers. Moreover, the energy and

**Table 7.** Distribution of travelers according to sensory evaluation of cola served with snacks.

Opinion	Snack items Cola )		
	Taste	Smell	Colour
	%	%	%
Like extremely	30	30	32
Like very much	4	6	6
Like moderately	24	30	18
Like slightly	24	16	24
Neither like nor dislike	10	6	6
Dislike slightly	0	0	0
Dislike moderately	2	0	2
Dislike very much	2	4	8
Dislike extremely	4	8	4
Total	100	100	100

**Figure 3.** Distribution of travelers according to overall acceptance of snack items (cola).

saturated fat content of snack II and the energy, fat, saturated fat and sodium contents of snack III met more than 20% of the RDA of adults. This is not healthy for frequent travelers, for in the long run, it may lead to obesity and related health risks.

It was interesting to note that snack III, which is high in energy, saturated fat and sodium content was liked by a majority of the passengers (54%). In light of this passenger opinion, it can be stated that the airline needs to prepare snacks low in energy, saturated fat and sodium, in addition to satisfying the sensory aspects of

taste perception by the passengers,

### Conclusion

The results showed that when the full day's nutrient content is considered, there is a possibility of meeting or exceeding the recommended dietary allowances with respect to macronutrients and sodium. Hence the total energy, carbohydrates, total fat, saturated fat and sodium content with respect to the full day's meal, (when

**Table 8.** Correlation between sensory characteristics and overall acceptability food items served as snack.

<b>Food items</b>	<b>r(Correlation coefficient)</b>
<b>Croissant</b>	
Taste	0.98
Smell	0.99
Colour	1
<b>Coffee</b>	
Taste	0.81
Smell	0.80
Colour	0.86
<b>Juice</b>	
Taste	0.90
Smell	0.93
Colour	0.93
<b>Cola</b>	
Taste	0.90
Smell	0.91
Color	0.95

r was calculated using Pearson's correlation at  $p < 0.05$

traveling on a long duration flight) have to be reduced in airline food. However, meeting the days Recommended Dietary Allowances with respect to all micronutrients, except vitamin C is questionable.

It was of interest to note that the majority of travelers disliked slightly or moderately most of the food items except croissant with chocolate served as snack. Though safety is of paramount importance with respect to airline meals, taste and appeal of the food need not be compromised (Grammatikopoulou et al., 2007). The Libyan Airline needs to seriously look into the reasons for discontent of the travelers and improve the palatability and nutritive value of snacks in the best interest of the health of travelers and prioritize customer satisfaction.

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