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MICROBIOLOGICAL INVESTIGATION AND NUTRITIONAL EVALUATION OF SELECTED FAST FOOD MEAT

By

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ABSTRACT

The study was designed into two parts : the first part was to determine individual attitudes and beliefs toward fast food in general. One hundred individuals (15-45 yrs old) were involved in this study (50 males and 50 females). The second part of the study was carried out to evaluate microbiological contamination and nutritive value of the selected fast food meat (Hardee's fried burger, Saudi-American burger, kentucky fried chicken, Al-Baik broast chicken and shawerma beef). The results indicated that individuals 25-45 yrs. old were the most fast food consumers. The main reason behind increasing individual's preferences toward fast food was found to be for fun and inspiration. Among

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individuals under study 46% of males and 20% of females purchased fast food more than 4 times per week. Prevalence of overweight and obesity respectively were 38% and 22% among males and 34% and 14% among females. Bacillus cereus and E. coli were detected in a number of less than 10/g in all the selected fast food meat. The number of coliforms detected in Hardee's burger and Saudi-American burger were 10/g, while less than 10/g were detected in the remaining fast food meat. However, the number of Staph. aureus detected in Hardee's burger and Saudi-American burger was 20/g and 10/g respectively. On a per 100 g basis, energy (Kcal), protein (g), fat (g) and sodium (mg) content were found in the range of 179.62-295.29, 13.05-26.06, 8.9-21.13 and 640-920 respectively. Sodium content of all the selected fast food meat exceeded the recommended daily adequate intake for adults (males and females). The observations of the present study indicated the need for a nutrition education program to correct consumers' attitudes and beliefs towards fast food and to provide information on how a given menu item contributes to their dietary goal.

INTRODUCTION

As more and more meals are consumed away from home, the responsibility of providing nutrition has shifted from mother who was visible and an accepted authority figure to the unknown invisible person (the person involved in the preparation of food in the restaurant). In addition to

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this change in food habits, there have been other problems concerning fast food meals such as nutrient retention and microbiological contamination of the prepared food (Appledorf, 1979).

Because the bacteria that cause most of the food poisoning cases are everywhere in the environment, contamination of food is also universal (U.S. Department of Agriculture, 1980). Most food borne bacterial poisoning can be prevented by proper handling, preparation, and storage of food in restaurants institutions and homes.

The purpose of this study was to determine the microbial contamination and nutritive value of selected white and red meat served in fast food restaurants in Jeddah area.

MATERIAL AND METHODS

The study was designed in two parts :

Part I :

A survey was carried out to find out the most common fast food items consumed and to study individual attitudes towards fast food in general. The survey included 100 of Saudi individuals (50 males / 50 females) from Jeddah area who purchased fast food, their ages ranged between 15 and 45 years. A written questionnaire was developed for the study to gather information about the subjects' educational levels, their occupations, socioeconomic status, frequency of eating fast food and reasons behind their preferences of fast food.

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Nutritional status of the individuals under study were evaluated through anthropometric measurements : height (cm) and weight (Kg) of the subjects were recorded and body mass index [wt (kg) / Hf (m^2)] was calculated (James, 1976). The questionnaire was distributed by the food and nutrition students (to their family members, friends, relatives and their neighbors).

Part II :

The second part of the study was carried out to investigate microbiological contamination and nutritive value of the selected fast food meat from part one of the study. Five common fast food meat were selected : Hardee's beef burger (fried B), Saudi-American burger (Regular B), kentucky fried chicken, Al-Baik chicken broast and shawerma beef.

Microbiological Investigation :

Preparation and dilution of food homogenate for the microbiological determination were done at Nashar laboratory in Jeddah, according to the technique recommended by ICMSF (1978). Special attention was paid to those organisms which claim a remarkable significance concerning spoilage and hygienic aspects (Bacillus cereus, coliforms, E. coli, Staphylococcus aureus, Salmonella, Clostridium prefringens, Listeria monocytogenes). The graving calories were counted per gram of meat.

Proximate Analysis :

The meat portions of the selected fast food were chemically analyzed to determine : moisture, protein, fat, ash and salt. Five replications were done for each analysis (the results were represented as the average).

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The moisture, protein (Kjeldahl method), fat (using soxhelt apparatus) and ash were determined using the methods recommended by A.O.A.C. (1985). Sodium chloride content was determined using Volhard silver nitrate titration method (Kolchov, 1952). Sodium content (mg/100 g) was calculated based on the fact that salt contains 40% of its weight sodium (Bennion, 1979). Carbohydrate was calculated by difference. Total energy was calculated by multiplying grams of fat by 9 Kcal, protein and carbohydrate by 4 Kcal/g. Nutritive value of the selected fast food meat (energy, protein, fat and sodium) was presented as a percentage of 1/3 RDA for males and females 25-45 yrs old (Food and Nutrition Board, 1989).

Statistical Analysis :

Results were represented as means and percentages. Data were subjected to statistical analysis, paired t-test was used to determine significant differences in nutrient content of both types of hamburger and the two types of chicken. The analysis were done using a personal with Excel Package for statistics.

RESULTS AND DISCUSSION

Descriptions of individuals (males/females) involved in the present study who purchased fast food are presented in table (1). It was found that individuals from the age group 25-45 yrs (66% males and 54% females) were the most fast food consumers followed by individuals from the age group 19-24 yrs (24% males and 44% females). Most of male subjects (58%) were unmarried while most females (60%) were married. Fifty six percent of males and 20% of females had a secondary level of education. Thirty four percent and

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66% of males were students and employees respectively, while 54% and 18% of females were students and employees.

Individuals' Attitudes Towards Fast Food :

Results of subjects' responses to the questionnaire concerning fast food are presented in table (2). The majority of males (54%) and females (80%) purchased fast food 1-3 times/week, 24% and 14% of males and females respectively purchased fast food 4-6 times/week, while 22% of males and 6% of females purchased fast food 7-10 times/week. According to Howard and Herbold (1982) nutritional problems may result if fast food is consumed frequently and regularly. Fast food meals are at risk of some nutrient inadequacies coupled with caloric excesses, both due to the nature of fast food menus and consumer selections.

In the present study the majority of subjects (62% of males and 72% of females) preferred eating fast food during supper. Reasons behind increasing preferences to fast food among males and females were found to be in this order : for fun and inspiration (48% of males and 64% of females), for its good taste (26% of males and 28% of females), it's a way of time saving (14% of males and 4% of females) and due to women's work (12% of males and 4% of females). These results indicated that in Saudi Arabia women's work is not the main reason behind increasing individuals' interest in fast food.

Some males and females (30% and 16% respectively) reported that the price of fast food reflects its nutritive value. In addition, 76% of males and 66% of females reported that the taste of fast food is more important for them than its nutritive value. These two observations

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emphasize the importance of a nutrition education program to correct these beliefs.

In spite of the previous observations, 74% of males and 78% of females knew that consumption of fast food more frequently may lead to different diseases. Among males and females 54% and 56% respectively indicated that the consumption of fast food may lead to obesity, while 10% and 14% of males and females respectively indicated that hypercholesteremia may result.

Nutritional Status of Subjects Under Study :

Mean height, weight and body mass index (BMI) of subjects under study for the three age groups are presented in table (3). Nutritional status of individuals according to BMI is presented in table (4). Overweight and obesity represented 38% and 22% respectively among males, 34% and 14% respectively among females. This observation emphasizes that consumers need information on how given menu items contribute to their dietary goals.

Microbiological Evaluation :

Hardee's hamburger, Saudi-American burger, kentucky fried chicken, Al-Baik broast chicken and shawerma beef were the most common fast food consumed in Jeddah among individuals under study. Table (5) represents the results of microbiological investigations (no/g) of the selected fast food meat. Bacillus cereus and E. coli were detected in a number of less than 10 organisms per gram in all the selected fast food meat. The two types of hamburger contained coliforms (10/g), while the number of coliforms detected in Kentucky fried chicken, Al-Baik broast chicken and shawerma beef were less than 10/g.

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The number of Staph. aureus detected in Saudi-American burger and Hardee's burger were 10/g and 20/g respectively. A number of less than 10/g was detected in each of Kentucky fried chicken, Al-Baik broast chicken and shawerma beef. Negligible number of Salmonella and Clostridium pref. (no/g) were detected in all of the selected fast food meat.

Food which support growth best include proteinaceous food such as meat, meat products and dairy products (U.S. Department of Agriculture, 1980). The present study detected some contamination by microorganisms in the selected fast food meat. According to Haque et al. (1987), the most common food items that have been implicated as vehicles for microorganisms in Riyadh, Saudi Arabia were milk and milk products (68.0%), meat (10.8%), eggs (8.6%), desserts (7.2%) and rice (5.4%). The most common microorganisms that caused symptoms of food borne diseases in Saudi Arabia were : Staphylococcus aureus (59.6%), Bacillus cereus (13.04%), Clostridium prefringens and Clostridium botulinum (7.83%).

Any food which requires handling in preparation may therefore easily become contaminated. The organisms is not a hazard at very low levels normally present in food (Doyle, 1988 and Institute of Food Technology, 1988). The principal control measures for prevention of food borne disease are the use of adequate time temperature heat treatment of cooking procedures, avoidance of cross contamination of cooked or ready to eat food by utensils, equipment, or cutting surfaces that are not properly cleaned and disinfected after contact with fresh uncooked raw foods.

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The majority of serious food borne disease outbreaks occur as the result of improper attention to detail in food service establishments and in the home. The need for continuing education of all food handlers including consumers about the principals of prevention of food borne diseases is of great importance.

Nutritional Evaluation of Fast Food Meat :

Proximate composition of the selected fast food meat on a per item basis and on a per 100 g basis are presented in table (6). Energy content (Kcal) per 100 g meat were found to range from 179.62 for shawerma to 295.29 for Hardee's burger. Protein (gm/100 g) was found to range from 13.05 for Saudi-American burger to 26.06 for Kentucky chicken.

Fat content of the five selected fast food meat varied greatly. Fat content (gm/100 g) ranged from 8.9 for shawerma to 21.13 for Hardee's burger. Fat and protein content (gm/100 g) were significantly higher in Hardee's burger than that in Saudi-American burger and in kentucky fried chicken than that in chicken broast ($p<0.05$) as determined by t-test on a per item weight, fat and protein contents of Hardee's burger represented higher percentages of 1/3 RDA for males and females 25-45 yrs old (table 7 and figures 1 & 2). The same finding was detected regarding fat content of chicken broast as compared to Kentucky fried chicken, while protein content of both types of chicken (per item weight) represented more than 1/3 of RDAs (figures 1 & 2).

On the other hand, sodium content (mg/100 g) was found to range from 640 for Hardee's burger to 920 for chicken broast (table 6). However, the amount of sodium

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content in all of the selected fast food meat was considered to be higher than the recommended safe adequate daily intake for adults (males/females), 500 mg/day (table 7). Similar findings were reported by other investigators in other countries (Appledorf, 1974 and Howard and Herbold, 1982). People on restricted sodium diets should be aware of the relatively high sodium content of fast food.

The findings of the present study indicated the need for a nutrition education program to correct consumers' attitudes and beliefs regarding fast food. The nutrition education program which was recommended by Shannon and Park (1980) could be of great help at this point. This program consists of three parts : nutrition training for managers, a poster campaign for consumers and a computerized nutritional analysis of food items used to raise consumer awareness of the nutritional quality of food offered.

ACKNOWLEDGMENT

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Table 1 : Distribution of individuals (both sexes) who consumed fast food according to different criteria.

Criteria	Sexes			
	Males (50)		Females (50)	
	No.	%	No.	%
Age (yrs):				
15-18	5	10	1	2
19-24	12	24	22	44
25-45	33	66	27	54
Socioeconomic Status:				
Married	21	42	30	60
Unmarried	29	58	20	40
Educational Level:				
Read & write	2	4	-	-
Secondary level	28	56	10	20
University level	20	40	40	80
Type of Work:				
Housewife	-	-	14	28
Student	17	34	27	54
Employee	33	66	9	18

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Table 2 : Distribution of subjects' responses to questionnaire concerning fast food.

Questionnaire	Sexes			
	Males (50)		Females (50)	
	No.	%	No.	%
Frequency of eating fast food (times/week):				
1-3	27	54	40	80
4-6	12	24	7	14
7-10	11	22	3	6
Time for eating fast food:				
Lunch	13	26	4	8
Dinner	6	12	10	20
Supper	31	62	36	72
Reasons behind preferences to fast food:				
It's time saving	7	14	2	4
Due to women's work	6	12	2	4
For fun and inspiration	24	48	32	64
For its good taste	13	26	14	28
Eating fast food is usually with:				
Family members	22	44	43	86
Friends	21	42	6	12
Individuals	7	14	1	2
Price of fast food usually reflects its nutritive value:				
Yes	15	30	8	16
No	35	70	42	84

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(Table 2 contd.)

Questionnaire	Sexes			
	Males (50)		Females (50)	
	No.	%	No.	%
Taste of fast food is more important than its nutritive value:				
Yes	38	76	33	66
No	12	24	17	34
Consumption of fast food frequently may lead to these diseases:				
Obesity	27	54	28	56
Underweight	4	8	3	6
High blood pressure	1	2	-	-
Hypercholesteremia	5	10	7	14
Heart disease	-	-	1	2

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Table 3 : Anthropometric measurements (weight, height, body mass index - BMI) of individuals according to different age groups.

Age (yrs)	Sexes					
	Males (50)			Females (50)		
	Wt (Kg)	Height (cm)	BMI	Wt	Ht	BMI
15-18	72.2	162.8	27.9	55.0	154.0	23.2
19-24	71.1	171.8	23.9	91.2	144.1	23.4
25-45	80.4	171.3	26.6	73.0	159.4	24.9

Table 4 : Nutritional status of individuals (males/females) under study according to body mass index (BMI).

Nutritional Status	Sexes			
	Males (50)		Females (50)	
	No.	%	No.	%
Normal	14	28	25	5
Overweight	19	38	17	34
Obese	11	22	7	14
Underweight	6	12	1	2

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Table 5 : Microbiological investigations (no/g) of the selected fast food meat.

Microorganisms	Fast Food Meat				
	Hardee's burger	Saudi-American burger	Kentucky fried chicken	Al-Baik broast chicken	Shawerma beef
Bacillus cereus (no/g)	<10	<10	<10	<10	<10
Coliforms (no/g)	10	10	<10	<10	<10
E. coli (no/g)	<10	<10	<10	<10	<10
Staph. aureus (no/g)	20	10	<10	<10	<10
Salmonella (no/25 g)	neg.	neg.	neg.	neg.	neg.
Clostridium perf. (no/g)	neg.	neg.	neg.	neg.	neg.

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Table 6 : Proximate composition of the selected fast food meat.

Fast food meat	Weight (gm)	Energy (Kcal)	Moisture (gm)	Ash (gm)	Protein (gm)	Fat (gm)	Carbohydrates (gm)	Salt (gm)	Sodium (mg)
Hardee's burger	84	248.04	39.56	4.68	10.95	17.75	6.12	1.34	537.6
(Fried B)	100	295.29	47.10	5.57	18.99	21.13	7.29	1.60	640.0
Saudi-American burger	75	145.22	42.98	4.51	9.79	7.73	11.56	1.58	630.0
(Regular B)	100	198.63	57.30	6.01	13.05	10.31	15.42	2.10	840.0
Kentucky fried chicken	125	364.80	57.00	6.70	32.57	22.13	8.85	2.25	900.0
(Kentucky CH)	100	291.86	45.60	5.36	26.06	17.70	7.08	1.80	720.0
Al-Baik broast chicken	325	743.50	182.70	17.86	77.86	43.18	10.82	7.48	2990.0
(Chicken B)	100	228.77	56.22	5.50	23.96	13.29	3.33	2.30	920.0
Shawerma beef	50	89.81	31.23	2.81	11.42	4.45	1.02	1.90	360.0
	100	179.62	62.40	5.62	22.84	8.90	2.04	1.80	720.0

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Table 7 : Nutritive value of fast food meat compared to 100 and 1/3 of RDA for males and females 25-45 years old.

Fast food meat	Sex	Energy		Protein		Fat		Sodium	
		%RDA	% 1/3 RDA	%RDA	%1/3 RDA	%RDA	% 1/3 RDA	%RDA	% 1/3 RDA
Hardee's burger	Male	8.50	25.66	17.40	52.14	18.36	55.07		
(Fried B)	Female	11.27	33.82	21.90	65.70	24.21	72.62	107.4	322.23
Saudi-American burger	Male	5.10	15.02	15.50	46.62	7.99	23.90		
(Regular B)	Female	6.60	19.80	19.58	58.76	10.54	31.63	126.0	377.99
Kentucky fried chicken	Male	12.57	37.73	51.69	155.09	23.05	68.66		
(Kentucky CH)	Female	16.58	49.74	65.14	195.40	30.18	90.55	180.0	539.99
Al-Baik broast chicken	Male	25.63	76.91	123.50	370.70	44.65	133.90		
(Chicken B)	Female	33.79	101.38	155.72	467.35	58.80	176.70	598.0	1793.96
Shawerma beef	Male	3.09	9.29	18.13	54.38	9.20	13.81		
	Female	4.08	12.24	22.84	68.54	0.11	0.33	72.0	215.9

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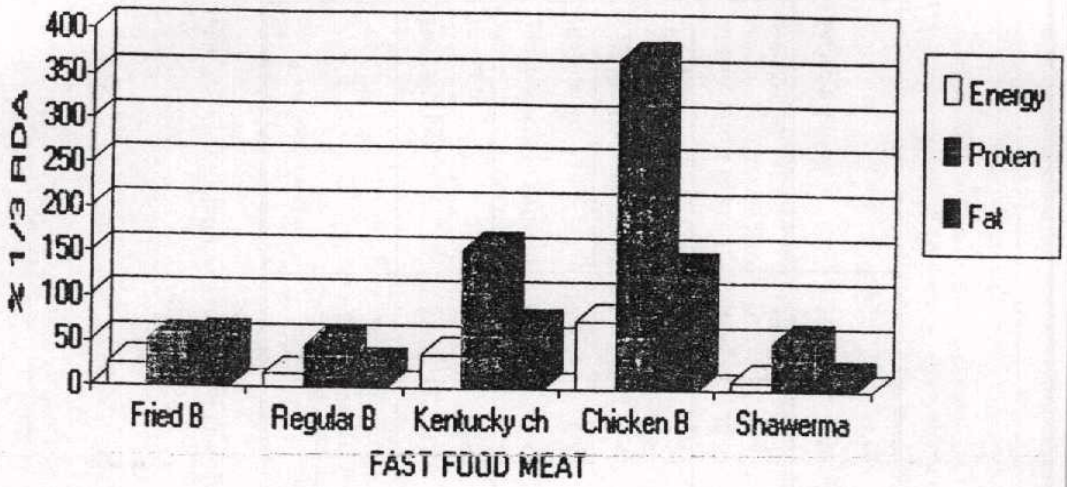

Fig. 1 : Nutritive value of fast food meat (energy, protein and fat) as percent of 1/3 RDA for males 25-50 years old.

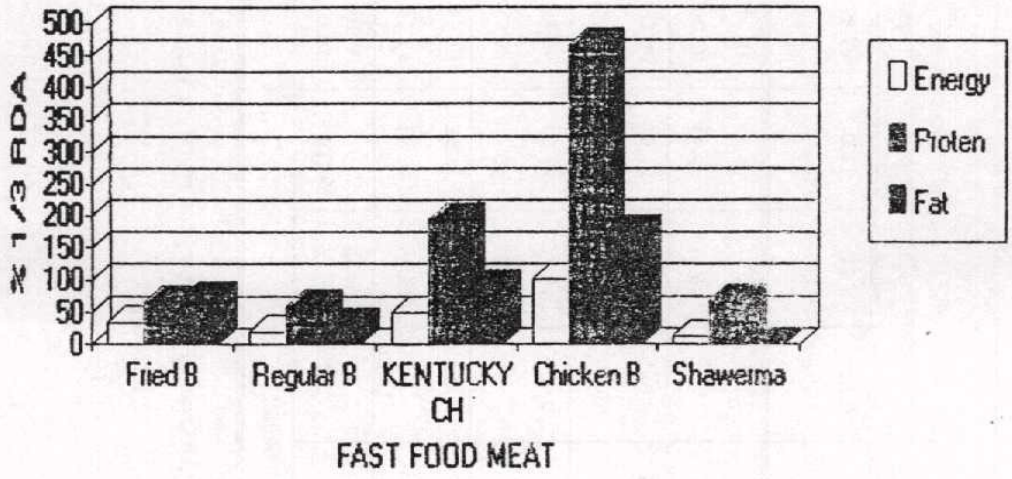

Fig. 2 : Nutritive value of fast food meat (energy, protein and fat) as percent of 1/3 RDA for females 25-50 years old.

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الفحص الميكروبيولوجي والتقييم الغذائي لبعض لحوم الوجبات السريعة

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اشتملت الدراسة على جزئين : الأول لتقدير اتجاه ومعتقدات الأفراد تجاه الوجبات السريعة بوجه عام. وقد اشتملت الدراسة على ١٠٠ فرد تراوحت أعمارهم مابين ١٥ - ٤٥ عام (٥٠ ذكور و ٥٠ إناث). الجزء الثاني من هذه الدراسة صمم لتقدير مدى التلوث الميكروبيولوجي وتقدير القيمة الغذائية للحوم الوجبات السريعة التي تم اختيارها (هارديز همبرجر ، الهمبرجر السعودي-الأمريكي،دجاج كنتاكي،دجاج البيك المحمر وشورمة اللحم الحيواني). أكدت نتائج الدراسة الحالية أن أكثر الأفراد استهلاكا للوجبات السريعة هم الأفراد من فئة العمر ٢٥ - ٤٥ عام. وقد كان السبب الرئيسي للأقبال على تناول هذه الوجبات السريعة هو للترويح عن النفس. كما وجد أن من بين الأفراد الذين اشتملت عليهم الدراسة أن هناك ٤٦٪ من الرجال و ٧٠٪ من النساء يشترون الوجبات السريعة أكثر من أربعة مرات أسبوعيا. أما عن حالات الزيادة في الوزن والبدانة بين أفراد الدراسة فقد كان على التوالي ٣٨٪ و ٢٢٪ من الرجال و ١٤٪ من النساء. وقد جاءت النتائج الميكروبيولوجية تبين أن عدد بكتريا باسيليس وبكتريا القولون الممرضة أقل من ١٠/جم في جميع أنواع اللحوم تحت الدراسة. في حين كان عدد الكوليفورم في كلا نوعي الهمبرجر (هارديز، السعودية الأمريكية) ١٠/جم، بينما كان العدد في عينات اللحوم الأخرى أقل من ذلك. عدد الميكروبات العنقودية الاستافيلوكوكس التي تم تقديرها في همبرجر هارديز وهمبرجر السعودي الأمريكي ٢٠/جم، ١٠/جم على التوالي.

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كما أوضحت النتائج أنه بتقدير القيمة الغذائية للحوم (على أساس ١٠٠ جم) فإن الطاقة (سعر)، البروتين (جم)، الدهون (جم) والصوديوم (ملج) كان في حدود القيم التالية على التوالي :(١٧٥,٦ - ٢٩٥,٥٩) (١٤,٠٥ - ٢٦,٦) و (٨,٩ - ٢١,١٣) و (٦٤٠ - ٩٢٠).

وقد تبين أن نسبة ماتحتويه هذه اللحوم من الصوديوم يعد مرتفع حيث أن قيمته تمثل أكثر من القيم المصرح باستهلاكها يوميا بالنسبة للبالغين (ذكور/إناث).

إن نتائج هذه الدراسة تؤكد الاحتياج إلى برنامج تثقيف غذائي لتصحيح اتجاه ومعتقدات أفراد المستهلكين للوجبات السريعة وكذلك لتزويدهم بالمعلومات التي توضح كيف أن محتوى الوجبة المختارة يؤثر في الهدف الغذائي المرجو تحقيقه.

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