

# Comparative Study on Health Knowledge About Biochemical Effect of Chocolate on Human Health Among Females and Males of Hail University

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**Abstract:** Studies on adverse effects produced by chocolate warn consumers about harmful effects of consumption of large amounts of chocolate but there are more studies about benefits of chocolate. A few studies have documented allergic reactions with chocolate in children. It was found that Chocolate had harmful effect on heart and caused heart burn due to its content which cause relaxation of oesophageal sphincter muscle and permits entrance of stomach acidic contents to the oesophagus. Recently, chocolate products have attracted the attention of many researchers because of their nutritional and medicinal Properties. There are rarely published studies from Saudia Arabia exploring the awareness about benefits of chocolate consumption. So, the present study was conducted with the objectives of evaluating the knowledge about benefits of chocolate consumption among students of Hail University in Saudia Arabia. A survey was planned to evaluate health knowledge about biochemical effect of chocolate consumption on human health among females and males of Hail University in Saudia Arabia through a previously standardized questionnaire for questions related to their dietary habits, preferences, knowledge about benefits of chocolate consumption, its benefits effect on health, types of chocolates and frequency of consumption along with self-reported height and weight. Results of study reported the importance of increasing information about health benefits of chocolate consumption to correct people's thinking that the chocolate is harmful. Also, the current study compared between females and males of Hail University in their knowledge.

**Keywords:** Cocoa / Chocolate, Benefits of Chocolate, Phenolic and Flavonoid Contents, Antioxidant Capacities of Chocolate

## 1. Introduction

Studies about chocolate consumption reported their possible health benefits that chocolate consumption reduced risk of chronic diseases, and various health benefits due to its antioxidant and anti-inflammatory potency. This is based on the ability of their bioactive constituents to regulate pro-inflammatory cytokines and their downstream biochemical pathways. In addition, phenolic and flavonoid contents and total antioxidant capacities of chocolate are higher than that of other phytochemical-rich foods and reduce the risk for

diabetes. [1, 9]. Recent studies found that dietary supplementation with chocolate and cocoa which rich in flavonoid exert a protective effect on low-density lipoprotein (LDL) oxidation, which reduced risk of atherosclerosis. [12, 13]. Several health effects of chocolate and cocoa which rich in flavonoid have been considered, including stimulation of the nervous system, facilitated digestion, reduced blood pressure, improved endothelial function and improved kidney and bowel function. In addition, its effect in treating anemia, mental fatigue, tuberculosis, fever, gout, kidney stones and malaria [2, 6, 8, 18]. Studies on the effect of chocolate consumption on cardiovascular diseases have reported that

dark chocolate induces coronary vasodilation, improves coronary vascular function, and decreases platelet adhesion. [3, 10, 11].

Recent studies, have shown that Antiobesity effects of chocolate due to its content (polyphenols) which have the ability to suppress fatty acid synthesis while stimulating cell energy expenditure in the mitochondria. Moreover, cocoa/ chocolate consumption also has beneficial effects on satiety, cognitive function, and mood. [4, 5, 15]. Studies on the effect of chocolate on metabolism of carbohydrate and Insulin Resistance reported that the possible mechanisms of action based on polyphenols content of chocolate which cause inhibition of carbohydrate digestion and glucose absorption, stimulation of insulin secretion, modulation of glucose release from the liver, activation of insulin receptors and glucose uptake in the insulin sensitive tissues, and modulation of intracellular signaling pathways and gene expression. All these mechanisms improve acute insulin secretion and insulin sensitivity. [14, 17]. Various studies about benefit of chocolate in Inflammatory Bowel disease (IBD) indicate that pure polyphenols content of chocolate play an anti-inflammatory role via the modulation of intracellular signaling cascades in intestinal cells. The extract was shown to reduce weight loss, improve normal stool consistency, and reduce or eliminate visible blood in feces. [5].

The antioxidant properties of cocoa or its products enriched in flavonoids may help protect against cancer and diseases in which oxidative stress is a causal or contributing factor through the scavenging of active oxygen radicals generated in reactions initiated by mitomycin C. [7, 12, 16]. Studies demonstrated that a cocoa polyphenol extract help delay age-related brain impairments in neurodegenerative diseases. [18]. This study was undertaken with the objective of assessing the health knowledge about chocolate consumption and its effects on human health by evaluating health knowledge about biochemical effect of chocolate consumption on human health among females and males of Hail University, then Comparing between females and males of Hail University. Also, this report aims to review the available literature on the various effects of chocolate consumption on human health to correct people's thinking that the chocolate is harmful.

## 2. Materials and methods

### 2.1. Design, Sample and Data Collection

The study design was a cross-sectional survey and was conducted at the University of Hail during first semester

2017-2018. Approximately, a random sample size of 200 samples (100 students from female campus and 100 from male campus) was enrolled in the study by using online student forum. The questionnaires were posted on line student forum for answering with the requisite instructions on how they fill and brief purpose about the study. Answered questionnaires were later downloaded. Body mass index (BMI) which is the ratio of weight (kilograms) to the square of height (meters) was used to assess body weight status. According to the WHO's classification for BMI, weight status was classified into four categories: underweight (BMI  $\leq$  18.5), normal weight (BMI= 18.5-24.9), overweight (BMI= 25-29.9), and obese (BMI  $\geq$  30) (WHO expert consultation, 2004). The questionnaire was designed as shown in Table 3 which included questions related to study objectives to evaluate health knowledge about benefits of chocolate and its effects on the health among a random sample of students of Hail University. Then, comparing degree of knowledge between female and male.

### 2.2. Statistical Analysis

Statistical analyses were performed using the Statistical Package for Social Sciences (SPSS) software and Arab Processor in Social Statistics. Descriptive statistics such as means and standard deviations (SD) were calculated for non-parametric variables were tested by Chi-square tests. Differences were considered statistically significant at  $P < 0.05$  or  $P < 0.01$ . [19, 20].

## 3. Results and Discussion

Of 200 students participated in the study, 50 % were females and 50 % were males in age group 20-24 year. Detail of characteristics of participants shown in Table 1.

Table 1. Characteristics of the participants.

Variables	Minimum	Maximum	Mean	Standard deviation
Weight (kg)	40	195	69.96	19.03
Height (cm)	150	189	166.05	8.42
BMI (kg/m <sup>2</sup> )	15.92	67.47	25.21	5.88

Table 1 represent the characteristics of students participated in the current study. The mean weight was  $69.96 \pm 19.03$  kg and mean of height was  $166.05 \pm 8.42$  cm. Mean of BMI (mean  $\pm$  SD=  $25.21 \pm 5.88$ ) was higher than the international normal range (BMI 18.5 to 24.9) and was indicating that the subjects are equally at risk for overweight and obesity in near future.

Table 2. Weight status of the participants.

Variables	Answer	%	$X_c^2$ at $\alpha=0.01$	$X_c^2$ at $\alpha=0.05$	$X_c^2$
Weight status	Under wt.	11	13.28	9.49	50.82
	Healthy Wt.	41.5			
	Over Wt.	30			
	Obese	16.5			
	Severely Wt.	1			

Results from table 2 showed that there is a highly significant difference between categories of Weight status among students (16.5% obese, 30% over weight, 41.5% healthy weight, 11% underweight and 1% severely weight) at  $P < 0.05$  or  $P < 0.01$ .

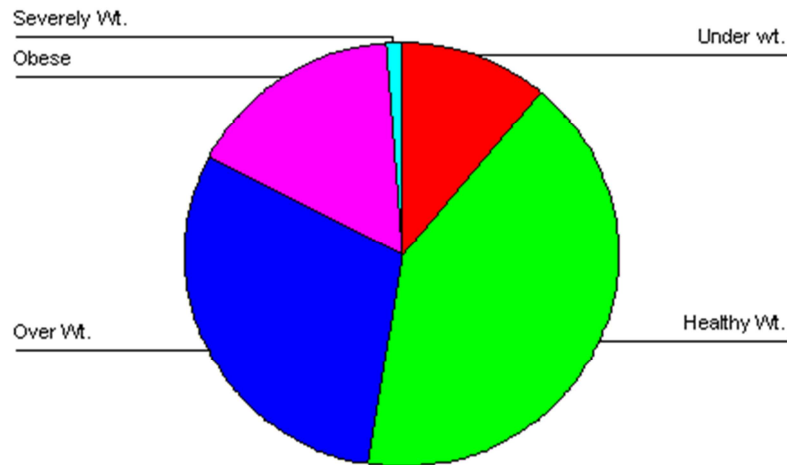


Figure 1. Weight status of the participants.

Table 3. Participants Responses for scientific knowledge questionnaire about Biochemical effect of chocolate consumption on human health.

$X_c^2$	$X_c^2$ at $\alpha=0.05$	$X_c^2$ at $\alpha=0.01$	%	Answers	Questions
129.14	7.81*	11.34**	4	1-Chocolate with biscuits	Q1- What is your favorite chocolate?
			0.6	2-Dark chocolate	
			71.8	3-Milk chocolate	
			23.6	4-Caramel chocolate	
49.56	3.84*	6.63**	85.2	1-Yes	Q2-Do you think chocolate has an important role in our live?
			14.8	2- No	
4.33	3.84*	6.63 <sup>N.S</sup>	39.6	1-Yes	Q3-Do you think chocolate activate the mind?
			60.4	2- No	
59.6	3.84*	6.63**	88.6	1-Yes	Q4-Do you think chocolate is useful for losing weight?
			11.4	2- No	
30.91	3.84*	6.63**	77.8	1-Yes	Q5-IS dark chocolate more beneficial to healthy body than white chocolate?
			22.2	2- No	
0.14	3.84 <sup>N.S</sup>	6.63 <sup>N.S</sup>	48.1	1-Yes	Q6-Does eating a lot of chocolate cause cancer?
			51.9	2- No	
4.08	3.84*	6.63 <sup>N.S</sup>	60.1	1-Yes	Q7-Do you agree that chocolate reduces heart disease?
			39.9	2- No	
66.91	3.84*	6.63**	90.9	1-Yes	Q8-Have you noticed that chocolate improves your mood?
			9.1	2- No	
11.16	3.84*	6.63**	33.3	1-Yes	Q9-Do you think chocolate is useful for diabetics?
			66.7	2- No	
77.87	7.81*	11.34**	62.4	1-Once	Q10-How many Chocolate do you eat per day?
			10.5	2-Two to three times	
			7.4	3-More than 3	
			19.7	4- I do not eat	
122.6	7.81*	11.34**	9.1	1-In the morning.	Q11-Your favorite time to eat chocolate?
			8.9	2-With meals	
			72.9	3-With coffee	
			9.1	4-Other	
2.13	3.84 <sup>N.S</sup>	6.63 <sup>N.S</sup>	57.3	1-Yes	Q12-Do you Prefer to eat chocolate permanently?
			42.7	2-No	
36.24	3.84*	6.63**	80.1	1-Yes	Q13-Do you think chocolate helps relax?
			19.9	2-No	
0.88	3.84 <sup>N.S</sup>	6.63 <sup>N.S</sup>	45.3	1-Yes	Q14-Do you think chocolate has a useful role for skin?
			54.7	2-No	
7.95	3.84*	6.63**	35.9	1-Yes	Q15-Do you think that chocolate is used to treat certain condition (such as: high blood pressure)?
			64.1	2-No	
20.98	3.84*	6.63**	27.1	1-Yes	Q16-Do you think chocolate has a role in the treatment of atherosclerosis?
			72.9	2-NO	
29.59	3.84*	6.63**	22.8	1-Yes	Q17-Do you think chocolate has a useful role to treat stroke?
			77.2	2-No	

\* = Significant at  $\alpha$  0.05 level \*\* = Significant at  $\alpha$  0.01 level (Highly Significant) N.S = Non-significant

Results from table 3 showed that There is a high significant difference between answer levels for all questions from question 1 to question 18 except questions (4, 7, 8, 13 and 15) there is a none significant difference between answer levels. Results showed that; 71.8 % of students prefer Milk chocolate; 85.2% of students know that chocolate has an important role in live; 39.5% know that it activate the mind and 90.9% of students noticed that it improve their mood. This knowledge is consistent with literature reports that chocolate stimulate serotonin production. Walcutt *et al* (2012).

The results also concluded that 88.6% of students have a background about useful role of chocolate in losing weight. This knowledge is consistent with previous reports by Ferrazzano *et al* (2009) who hypothesized that the polyphenols contained in cocoa have antiobesity effects due to their ability to suppress fatty acid synthesis while stimulating cell energy expenditure.

The present study represents that 77.8% of students have a

good knowledge about types of chocolate and know that dark chocolate is more beneficial to healthy body than milk chocolate; 51.9% know that eating a lot of chocolate does not cause cancer. This knowledge supported by a study conducted by Serafini *et al* (2003) who found that the antioxidant properties of cocoa or its products enriched in flavonoids help to protect against diseases in which oxidative stress is contributing factor. Results of the current study found that 60.1% of students know that chocolate reduce heart disease. Katz *et al* (2011) and 33.3% know that it is useful for diabetics. Romier *et al* (2009)

While 62.4% of them eat chocolate one time/day; 72.9% eat it with coffee; 57.3% Prefer to eat chocolate permanently; 80.1% think chocolate helps relax; 45.3% think chocolate has a useful role for skin; 35.9% think that chocolate is used to treat certain condition (such as: high blood pressure); 27.1% know that chocolate has a role in the treatment of atherosclerosis and only 22.8% of students know that chocolate has a useful role to treat stroke. Baba S *et al* (2007).

**Table 4.** Comparison between male and female students in degree of knowledge about beneficial of chocolate consumption.

$\chi^2$	$\chi^2$ at $\alpha=0.05$	$\chi^2$ at $\alpha=0.01$	Female%	Male%	Answers	Questions
1.77	5.99 <sup>N.S</sup>	9.21 <sup>N.S</sup>	0.9	3.1	1-Chocolate with biscuits	Q1- What is your favorite chocolate?
			0.3	0.3	2-Dark chocolate	
			22.2	49.6	3-Milk chocolate	
			10.5	13.1	4-Caramel chocolate	
6.79	3.84 <sup>*</sup>	6.64 <sup>**</sup>	24.5	60.7	1-Yes	Q2-Do you think chocolate has an important role in our live?
			9.4	5.4	2- No	
3.02	3.84 <sup>N.S</sup>	6.64 <sup>N.S</sup>	9.4	30.2	1-Yes	Q3-Do you think chocolate activate the mind?
			24.5	35.9	2- No	
3.82	3.84 <sup>N.S</sup>	6.64 <sup>N.S</sup>	27.1	61.5	1-Yes	Q4-Do you think chocolate is useful for losing weight?
			6.8	4.6	2- No	
2.76	3.84 <sup>N.S</sup>	6.64 <sup>N.S</sup>	23.1	54.7	1-Yes	Q5-IS dark chocolate more beneficial to healthy body than white chocolate?
			10.8	11.4	2- No	
0.1	3.84 <sup>N.S</sup>	6.64 <sup>N.S</sup>	17.1	31.1	1-Yes	Q6-Does eating a lot of chocolate cause cancer?
			16.8	35	2- No	
0.88	3.84 <sup>N.S</sup>	6.64 <sup>N.S</sup>	18.2	41.9	1-Yes	Q7-Do you agree that chocolate reduces heart disease?
			15.7	24.2	2- No	
4.6	3.84 <sup>*</sup>	6.64 <sup>N.S</sup>	27.9	63	1-Yes	Q8-Have you noticed that chocolate improves your mood?
			6	3.1	2- No	
0.01	3.84 <sup>N.S</sup>	6.64 <sup>N.S</sup>	11.1	22.2	1-Yes	Q9-Do you think chocolate is useful for diabetics?
			22.8	43.9	2- No	
2.23	5.99 <sup>N.S</sup>	9.21 <sup>N.S</sup>	19.4	43	1-Once	Q10-How many Chocolate do you per day?
			4.3	6.3	2-Two to three times	
			1.4	6	3-More than 3	
			8.8	10.8	4- I do not eat	
0.39	5.99 <sup>N.S</sup>	9.21 <sup>N.S</sup>	2.3	6.8	1-In the morning.	Q11-Your favorite time to eat chocolate?
			2.8	6	2-With meals	
			25.4	47.6	3-With coffee	
			3.4	5.7	4-Other	
0.98	3.84 <sup>N.S</sup>	6.64 <sup>N.S</sup>	17.1	40.2	1-Yes	Q12-Do you Prefer to eat chocolate permanently?
			16.8	25.9	2-No	
0.86	3.84 <sup>N.S</sup>	6.64 <sup>N.S</sup>	25.4	54.7	1-Yes	Q13-Do you think chocolate helps relax?
			8.5	11.4	2-No	
0.69	3.84 <sup>N.S</sup>	6.64 <sup>N.S</sup>	13.4	31.9	1-Yes	Q14-Do you think chocolate has a useful role for skin?
			20.5	34.2	2-No	
0.29	3.84 <sup>N.S</sup>	6.64 <sup>N.S</sup>	13.4	22.5	1-Yes	Q15-Do you think that chocolate is used to treat certain condition (such as: high blood pressure)?
			20.5	43.6	2-No	
0.32	3.84 <sup>N.S</sup>	6.64 <sup>N.S</sup>	8	19.1	1-Yes	Q16-Do you think chocolate has a role in the treatment of atherosclerosis?
			25.9	47	2-No	

$X_c^2$	$X_c^2$ at $\alpha=0.05$	$X_c^2$ at $\alpha=0.01$	Female%	Male%	Answers	Questions
0	3.84 <sup>N.S</sup>	6.64 <sup>N.S</sup>	7.7 26.2	15.1 51	1-Yes 2-No	Q17-Do you think chocolate has a useful role to treat stroke?

\* = Significant at  $\alpha$  0.05 level \*\* = Significant at  $\alpha$  0.01 level (Highly Significant)

N.S = Non-significant

Results from table 4 showed that there is a none significant difference in degree of knowledge between male and female students in all questions except question number (3). Statistical analysis showed that 60.7% of male students know the important role of chocolate in our live while only 24.5 % of female know the same effect.

Published studies from Saudia Arabia exploring the awareness, safety perception and practices about benefits of chocolate consumption are rarely. Results of the present study was concluded that students of University have a moderate knowledge about Biochemical effect of chocolate consumption on human health.

#### 4. Conclusion and Recommendation

The consumption of cocoa and chocolate flavonoids still presents an exciting area of further nutritional, clinical and epidemiological research, with significant implications for health protection in humans.

In the current work, the study participants (students of University) are aware about the benefits of chocolate but have a moderate knowledge concerning Biochemical effect of chocolate consumption on human health. While the comparison between male and female students in degree of knowledge showed that there is a none significant difference in degree of knowledge between male and female students in most questions.

The current study recommended the need of strengthen the student information by conducting well-designed seminars, programs and workshops or by health education program and booklets and distribute to the students to correct their thinking that the chocolate is harmful.

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