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## RESEARCH ARTICLE

### THE CONCEPTIONS OF FERMENTATION AND FERMENTED FOODS AMONG SAUDI WOMEN IN JEDDAH

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#### ABSTRACT

The purpose of this study to identify the extent of awareness and knowledge of the Saudi women in Jeddah city of the conceptions of fermentation and fermented foods. Questionnaires were designed and distributed among female students (n= 174) at King Abdul-Aziz University. The results demonstrated that over 60% of respondents have known about the fermentation process in food production and its essential step in making cheeses and yogurt. On the other hands, Saudi women showed a low level of awareness (25%, 8%, and 17 %) in the fermentation process involved some fermented products such as soy sauce, cocoa and coffee beans respectively. Similarly, only 18% of Saudi women had known about the beneficial effect of microorganism in improving fermented cereals quality and removes toxic compounds. A low percentage of Saudi women (16%) had knowledge about probiotic bacteria in fermented foods. In conclusion, this study exhibited a moderate level of awareness among Saudi women about the fermentation process and its used in food production and preservation.

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## INTRODUCTION

Fermentation using microorganisms is an ancient technique. Yeast has been used in industrial microorganism i.e. wine and beer production, cheeses and the dough leavening for 1000's of years (Shori, 2015). Fermented foods have defined as subjected foods to the action of micro-organisms or enzymes leading to desirable biochemical changes with significant modification to the food (Shori, & Baba, 2013 & 2014). Fermentation in food processing is the conversion of sugars to alcohols and carbon dioxide or organic acids under anaerobic conditions using microorganisms such as molds, yeasts, bacteria or a combination (Shori, & Baba, 2014; Shori, 2016). Fermented foods have beneficial properties related to lactic acid bacteria (LAB) particularly probiotics. This beneficial microflora found in the gastrointestinal tract and confirmed to exert health-promoting influences in humans and animals (Marteau & Rambaud, 1993; Shori, 2015 & 2017). Fermented foods can be classified as beverages, products of cereal, dairy, fish, fruit and vegetable, legumes and meat. Many fermented milk products contain living microorganisms either LAB alone or both LAB and yeast (mixed cultures). The nutrients in milk i.e. carbohydrates, amino acids, lipids, vitamins, and minerals are required by

lactic acid bacteria for growth which leads to a noticeable change in the content of some nutrients in the new product i.e. yogurt and sour milk (Aboufazli et al., 2016). Fermentation improved the nutrient quality of the final product and reduced the content of antinutritional factors to a safe level (Obizoba & Atee, 1991). Fermented foods have many advantages over the raw ingredients from which they are made. This includes improved flavor and texture, appearance and aroma, synthesize vitamins i.e. B-12, reduce or eliminate carbohydrates and increase storage life (Shori et al., 2016). No research has been conducted about the level of awareness and knowledge of the Saudi women in Jeddah city of the fermentation process and fermented foods. Therefore, this study has been carried out in order to identify the extent of awareness and knowledge of the Saudi women in Jeddah city of the conceptions of fermentation and fermented foods.

## MATERIALS AND METHODS

To capture Saudi women's perspectives of fermentation and its products, the descriptive quantitative design was chosen. After a widespread review of the current literature on the fermentation process and fermented food products factors, a questionnaire was constructed to identify the degree of awareness and knowledge of the fermentation process and products. The questionnaire was written in two languages, Arabic and English to avoid ambiguity and misunderstanding. There were three response options for each question (yes, no and maybe).

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The data was collected between February and March 2016. Saudi women (n= 174) were randomly selected from King Abdulaziz University, Jeddah. The questionnaire contained two sections. Section A is a demographic questions about the participant's background such as age, educational background (diploma, bachelor, master and PhD). Requests for questionnaires were received from 174 participants and 6 were returned incomplete. The sample size was 180 respondents calculated based on the following formula:

$$SS = \frac{(Z^2) \times (p) \times (1 - p)}{C^2}$$

SS = Sample size

Z = Z-value

P = Percentage of population.

C = Confidence interval

The variation of participants in the educational background was a diploma (19), bachelor (146), Masters (7) and Ph.D. (2). Participants (142) were in age between 20 and 29. The majority of participants (147) were from the faculty of sciences, economy, and administration in addition to art and humanities (Table 1).

**Statistical analysis:** Data were analyzed using descriptive statistic and chi-square. Statistical analyses were done using SPSSV20 statistical software.

## RESULTS AND DISCUSSION

Table 2 shows the frequency and percentage (%) of the responses to the questions, which measured the description of Saudi women's perceptions in Jeddah city of the fermentation and fermented foods. The results showed that 68.4% of the respondents know the fermentation process and 45% they were consumed fermented foods each day. In addition, the highest percentage of respondents (76%) never heard of probiotics fermented foods. More than half of the respondents showed awareness of microbes involved in the fermentation process. The participants have known that cheese and yogurt have made by using bacteria during fermentation (70.7%) and resulted in their flavors and aromas (55.7%). Based on the present results, participants (85%) do not know the flavor of cocoa beans was developed during fermentation (Table 2). Similarly, almost 125 participants (71%) did not know that coffee beans must ferment first by certain microbes to make coffee. Furthermore, 65% of the respondents have no information about the fermentation of cereals could improve the food quality and remove toxic as well as soy sauce is made from fermented

**Table 1. Frequency and percentage regarding demographic information**

		Frequency	Percent	Cumulative Percent
Education	Diploma	19	11	20.1
	bachelor's	146	83.9	94.8
	master	7	4.0	98.9
	PHD	2	1.1	100.0
Age	Less than 20	12	6.9	6.9
	20-29	142	81.6	88.5
	30-39	4	2.3	90.8
	40-59	16	9.2	94.3
College	Faculty of sciences	55	31.6	31.6
	Faculty of economy and administration	47	27.1	58.6
	Faculty of engineering	3	1.7	60.3
	Faculty of art and humanities	45	25.9	86.2
	Faculty of law	6	3.4	89.7
	Others	18	10.3	100.0

**Table 2: Frequency and descriptive of participants' responds**

Questions	Variables	Frequency	Percent	Cumulative Percent
Have you heard about Fermentation?	Yes	119	68.4	68.4
	No	39	22.4	90.8
	Maybe	16	9.2	100.0
Have you heard about probiotic bacteria in fermented foods?	YES	28	16.1	16.1
	NO	132	75.9	92.0
	MAYBE	14	8.0	100.0
Did you consume fermented foods daily?	Yes	78	44.8	44.8
	No	39	22.4	67.2
	Maybe	57	32.8	100.0
Did you know that microbes involved in fermentation process?	Yes	101	58.0	58.0
	No	49	28.2	86.2
	Maybe	24	13.8	100.0
Did you know cheese and yogurt are made using bacteria?	Yes	123	70.7	70.7
	No	38	21.8	92.5
	Maybe	13	7.5	100.0
Did you know that the flavor of cocoa beans is developed during fermentation?	Yes	13	7.5	7.5
	No	148	85.1	92.5
	Maybe	13	7.5	100.0
Did you know that dairy products gain their flavors and aromas by the lactic acid bacteria during fermentation?	Yes	97	55.7	55.7
	No	66	37.9	93.7
	Maybe	11	6.3	100.0
Did you know that to make coffee we must ferment the coffee beans first by certain microbes?	Yes	30	17.2	17.2
	No	125	71.8	89.1
	Maybe	19	10.9	100.0
Did you know that fermentation of cereals improves the food quality and remove toxic from it?	Yes	32	18.4	18.4
	No	113	64.9	83.3
	Maybe	29	16.7	100.0
Did you know that fermentation is the most important step in leavening bread?	Yes	137	78.7	78.7
	No	26	14.9	93.7
	Maybe	11	6.3	100.0
Did you know that soy sauce is made from fermented soy beans by fungi?	Yes	44	25.3	25.3
	No	114	65.5	90.8
	Maybe	16	9.2	100.0

leavening bread. Fermentation is one of the oldest methods and widely used for food preservation. Foods fermentation are based on the microorganisms involved in the fermentation (molds, bacteria, and yeasts). This is lead to form some compounds include organic acids (e.g., palmitic, pyruvic, lactic, acetic, propionic and butyric acids), alcohols (mainly ethanol) aldehydes and ketones (acetaldehyde, acetoin, 2-methyl butanol) (Muniandy et al., 2017; Shori, 2017). The bacteria involved in foods fermentation are not harmful to the people and possess enzymes such as proteases, amylases and lipases that hydrolyze food compounds into nontoxic products with desired textures, aroma and flavor (Shori & Baba, 2011; Shori & Baba, 2013; Shori & Baba, 2014; Baba et al., 2014; Shori, & Baba, 2015). Based on the present results, Saudi women showed high awareness about fermentation since traditional fermentation has been commonly used in Saudi kitchen especially dough leavening, sour milk, and yogurt. As expected, highly educated participants were likely to be known about the process and products of fermentation by bacteria and yeast which was responsible for the rich flavors, aroma and textures happened in these foods. In general, people in Saudi Arabia consumed usually cheeses and yogurt in their daily diet. This explained high responses were observed regarding using bacteria in yogurt and cheese manufacture. On the other hand, Saudi women showed very low awareness (25%, 8%, and 17 %) in the development process involved some fermented products such as soy sauce, cocoa and coffee beans respectively. the fermentation process is essential to developing soy sauce, chocolate and coffee properties with aroma and flavors impacted by microbial metabolites (Schwan & Graham, 2014). Although the influences of microorganisms to fermentation have been known for many years ago, these processes are still not well-known by many Saudi women. We believe that it is important to further educate Saudi women about fermented foods types and its production process.

The process of making yeast-leavened bread is well-known by women in Saudi Arabia because they consumed bread daily. Microorganism in food processing has a beneficial effect in improving cereals quality and removes toxic compounds (Tamang et al., 2016), however, only 18% of Saudi women appeared to be knowledgeable about this information. Illustrating this problem is the wrong idea that a lot of people think of microorganisms as harmful and dangerous because most people learn about microbes in the context of disease. This hypothesis could explain the low percentage of Saudi women (Table 2) who had known about probiotic bacteria in fermented foods.

## Conclusion

The overall findings of this study indicated that there was a high level of awareness among Saudi women about the fermentation process and it used in food production and preservation. However, Saudi women are less educated about the types of fermented foods particularly those commonly consumed in Saudi Arabia and the role of microorganism in food production.

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