Original Paper

Influence of Women Age on Berries Consumption: The Role of Liking and Properties of Berries as Determinants of Their Intake

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Abstract

Due to the benefits of berries to health and aging in women and the fact that as women age, they are increasingly concerned about remaining healthy and looking young, the aim of this paper is to determine if the consumption of berries among women is influenced by their age; also, to identify if the reasons why berries are ingested vary with age. This study evaluated berries intake and motives of consumption of 240 adult women from Jalisco, Mexico, ranging from 18 to 65 years old, divided into three groups: Young Adult Women (YAW, from 18 to 35 years old), Middle-Aged Adult Women (MAW, from 36 to 55 years old) and Older Adult Women (OAW, from 56 to 65 years old). Berries (blueberry, raspberry, strawberry and blackberry) consumption was collected by an adapted Food Consumption Frequency Questionnaire validated for Mexican population, and intake reasons were assessed by a qualitative section. Spearman's Correlations, ANOVA and Bonferroni test were done. While berries consumption lowers in the MAW group, it increases when women reach the advanced adulthood. YAW consumes berries mainly because of liking and OAW due to its properties. Only 60% of OAW consumes berries and frequency of consumption is occasional in all women, so policies to increase berries intake are needed.

Keywords

Berries consumption, age, women, anti-aging, liking, antioxidants, berries properties

1. Introduction

The potential health benefits of foods are one of the main reasons why consumers prefer to ingest certain type of products over others (Jaeger, Axten, Wohlers, & Sun-Waterhouse, 2009; Roininen, Lähteenmäki, & Tuorila, 1999; Roininen et al., 2001). Women, in particular, have been found to engage in more health-promoting behaviors than men and to have a healthier lifestyle and a greater interest in eating a diet that may benefit their long-term health, compared to men. In fact, numerous evidence shows that women's diets are healthier than men's (Arganini, Saba, Comitato, Virgili, & Turrini, 2012; Huntley, 2009; Prättälä et al., 2006); however, age is an important factor that can alter their food consumption habits, especially when taking into account that two of the main determinants of food choices for women are: disease prevention and the desire to delay the aging (Bennett, Clarkea, Kowalski, & Crocker, 2017; Fraser, Welch, Luben, Bingham, & Day, 2000; Holcomb, 1995).

The consumption of food rich in antioxidants has increased steadily in the last decades, due to the numerous health-promoting properties attributed to them (Huntley, 2009). Berries (blueberry, raspberry, strawberry and blackberry) have plenty of attributes. Besides being low in calories and a rich source of fiber, ascorbic acid, carotenes and polysaccharides, they are a rich source of bioactive compounds, such as phenolic compounds (including flavonoids such as anthocyanins and procyanidins), tannins and phenolic acids, substances that are considered antioxidants. These bioactive compounds have received considerable attention from researchers. So far, it has been found that they improve the markers of heart disease, help to prevent cancer of the digestive system, reduce the risk of mortality from stroke and improve the immune system (Gramza-Michałowska, Sidor, & Kulczynski, 2017; Heinonen, 2007; Ros et al., 2010). Clinical evidence indicates that a diet rich in berries helps to control and prevent chronic diseases. Also, consumption of berries improves the postprandial glycemic response, and its long-term intake can improve the lipid profile in plasma, reduce chronic inflammation and benefit cardiovascular health, especially in populations with a basal metabolic profile at higher risk of metabolic syndrome (Yang & Kortesniemi, 2015).

In recent years, there has been an increasing amount of research on the health benefits of berries antioxidants, many of them highlighting the effects on women (Huntley, 2009; Lehtonen et al., 2011). The studies focused on evaluating the consumption of berries in women have found that a relatively higher intake of these fruits is associated with lower rates of cognitive deterioration in older women (Devore, Kang, Breteler, & Grodstein, 2012), a reduction in memory loss (O'connor, 2012), and with a healthy aging in women over 50, which is mainly due to their flavonoids (Samieri, Sun, Townsend, Rimm, & Grodstein, 2014). Berries intake can also help to prevent breast cancer (Aiyer, Srivani, & Gupta, 2011) and to delay aging (Willis, Shukitt-Hale, & Joseph, 2009). It has also been found that the consumption of berries is positively related to a lower risk of death from cardiovascular diseases (cardiovascular disease mortality) in post-menopausal women (Mink et al., 2007).

The numerous attributes of berries, make its consumption on women worth studying, yet identifying how the consumption of these fruits varies according to women's age, may further help in creating

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policies to promote their consumption. Due to the above the aim of this paper is to determine if the consumption of berries among women is influenced by their age; also, to identify if the reasons why berries are ingested vary with age.

2. Method

2.1 Sample

A cross-sectional study was undertaken in Ciudad Guzman, Jalisco, Mexico, a region producing berries (Housni et al., 2018). The sample to be studied were 240 women between 18 and 65 years old, from Ciudad Guzman, Jalisco, Mexico. The sample was divided into the following age groups, according to the classification of Petry (2002): women from 18 to 35 years old, who are considered as Young Adult Women (YAW); women from 36 to 55 years old, considered as Middle-Aged Adult Women (MAW) and women from 56 to 65 years old, who are considered as Old Adult Women (OAW). The sociodemographic characteristics of the sample appears in Table 1. The average age of YAW was 24.88 ± 4.77, MAW was 43.35 ± 5.66 and OAW was 60.48 ± 2.95. The highest monthly salary was that of OAW (363.81 ± 325.90 USD), however, this group obtained the lowest average with respect to school years taken. YAW turned out to be the group with the highest number of school years attended (12.26 ± 3.69).

Table 1. Demographic Characteristics of the Three Age Groups

		Young Adult Women (YAW)	Middle-Aged Adult Women (MAW)	Older Adult Women (OAW)
Age ranges[1]		From 18 to 35 years old	From 36 to 55 years old	From 56 years to 65 years old
n		113	77	50
%		47.08	32.09	20.83
Age	Mean	24.88	43.35	60.48
	SD	4.77	5.66	2.95
Monthly income[2]	Mean	307.36	354.30	363.81
	SD	288.13	289.59	325.90
	Min	41.77	52.21	78.32
	Max	2,088.48	1,566.36	2,088.48
School years completed	Mean	12.26	11.49	8.66
	SD	3.69	4.37	4.81
	Min	2	1	0
	Max	19	19	19

[1]Age classification according with Petry (2002).

[2]American dollars (USD). The minimum monthly wage in Mexico in 2018 was 138.36 USD, according with Service tax administration (2018).

2.2 Instrument and Data Collection

An adapted Food Consumption Frequency Questionnaire validated for the Mexican population was applied (Macedo-Ojeda et al., 2013), which asked about berries consumption, considering as such: blueberry, raspberry, strawberry and blackberry. The method used was the same as the used by Housni et al. (2018), where the consumption of blueberry, raspberry and blackberry was questioned in grams or cups, and strawberry consumption in grams or pieces. The consumption frequency ranges used were those proposed by Willet (2013), which were chosen according to the exact and personal frequencies of each participant, which were also captured for further analysis. The amount of consumption was the one consumed each time berries are eaten. Subsequently, the reasons why berries are ingested were questioned. The application of surveys was carried out in local markets where berries are sold. The information was obtained by personnel with knowledge in health of the University Center of the South, University of Guadalajara, who were trained in the application of surveys.

2.3 Statistic Analysis

The data obtained was converted to monthly frequency, considering the daily consumption as a maximum of 30 days per month. The information regarding the amounts of intake was converted to grams, using as reference the weight of the established portions of berries, in the Mexican System of Equivalent Foods [SMAE] (Pérez, Palacios, Castro, & Flores, 2014). Per capita daily consumption was obtained, multiplying the frequency of consumption of each berrie, of each woman, by the amount of consumption referred, and dividing the result by 30 days per month. Finally, the consumption frequency data of each berrie type was averaged to obtain the average frequency of the four berries evaluated. In the case of the quantities, the consumption information of the four types of berries was added, to obtain the total consumption of all the berries, in grams, every time they are consumed and per capita by day. In addition to the averages and total consumption quantities, the standard deviation of the information was calculated.

The consumption reasons were grouped in the two most mentioned. The rest was considered as "other reasons". Frequency of participants was described as well as the percentage they represented for each motive. Per capita daily consumption and standard deviation were calculated for each reason.

The data was analyzed to evaluate its distribution by means of the Shapiro-Willk test. Spearman's rank correlations coefficient was applied, to correlate the age and the consumption data of each age group and the reason of consumption according to the age group. Size of Correlation Coefficient was taken from Mukaka (2012). A value of $p < 0.05$ was considered significant. To assess differences in berries intakes and reasons of consumption between age groups, an Analysis of Variance (ANOVA) test was performed with a *post hoc* multiple comparison Bonferroni test. Descriptive statistics and statistical analysis was carried out using STATA/SE V12.

2.4 Etic Considerations

This research is considered without risk in accordance with the Regulation of the General Health Law on Health Research (Official Gazette of the Federation [DOF], 2014), for which the consent of the

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participants was granted orally. The data were confidential and the name, address or telephone number of the participants was not requested, as it was irrelevant for this study and for the protection of the subject's identity.

3. Results

3.1 Consumption of Berries

Table 2 shows the consumption of berries by age group, including number of women who consume berries, frequency and amount of consumption and daily consumption per capita. It was identified that the percentage of YAW that consumes berries presented a greater tendency to ingest them. While 71.68% of YAW consume berries, only 60% of OAW reported consuming them, nevertheless, there were no statistically significant differences between the groups (p = 0.318). Despite the above, OAW were the ones who ingest berries most frequently with 5.6 ± 8.37 times per month. Regarding the amounts of consumption per capita, per day, YAW eats an amount of 89.35 ± 120.21 grams of berries, nevertheless, as age increases, consumption decreases to 73.32 ± 96.77 grams per day, but when women reach a stage where they are more than 56 years old, the intake increases to 89.38 ± 146.59 grams.

Although the per capita daily consumption is similar in YAW and OAW, the ration consumed each time berries are eaten in YAW is considerably higher than the other groups. However, no statistically significant differences were found. Spearman's rank correlations did not show strong correlation between any consumption variables and age, however, a negative correlation was find in MAW consumption (rho = -0.226 / p = 0.047*), which confirms that in this period, as age increase consumption decrease. ANOVA test neither showed any significant different between age groups (See Table 2).

Table 2. Berries Consumption by Age Group

		Young Adult Women (YAW)	Middle-Aged Adult Women (MAW)	Older Adult Women (OAW)	
Variable					ANOVA
Consumption	n	81	50	30	
	%	71.68	64.94	60	0.318
	rho	0.109[a]	-0.226[a]	0.142[a]	
	p-value	0.246	0.047*	0.324	
Monthly frequency of consumption	Mean	5.18	4.56	5.6	
	SD	5.82	6.01	8.37	0.559
	rho	0.056[a]	0.020[a]	0.048[a]	
	p-value	0.549	0.858	0.737	
Quantity consumed in grams[1]	Mean	423.95	357.01	332.98	0.517
	SD	715.71	617.23	573.95	

	rho	0.195[a]	-0.102[a]	0.123[a]	
	p-value	0.038*	0.377	0.391	
Daily consumption per capita in grams	Mean	89.35	73.32	89.38	
	SD	120.21	96.77	146.59	0.626
	rho	0.246[a]	0.033[a]	0.132[a]	
	p-value	0.008*	0.769	0.359	

SD = Standard deviation; *rho* = Spearman's rank correlation; *p* value from Spearman's rank correlation; ANOVA = *p* value from Analysis of Variance test between age groups; A value of p <0.05 was considered significant. [1]Grams consumed each time berries are ingested, according to the frequency of consumption expressed; * = Statistically significant differences; [a] = negligible correlation (0.00 to 0.30 and 0.00 to -0.30), [b] = low positive correlation (0.30 to 0.50), [c] = moderate positive correlation (0.50 to 0.70), [d] = high positive correlation (0.70 to 0.90), [e] = very high positive correlation (0.90 to 1.00), according with Mukaka (2012).

Although no differences were identified in the ANOVA test, Table 3 shows a multiple comparison Bonferroni analysis to identify the exact values between each comparison group. The results of this analysis proved that there are no statistical differences between the groups.

Table 3. Multiple Comparison Bonferroni Test in Berries Consumption by Age Group

			Young Adult Women (YAW)	Middle-Aged Adult Women (MAW)
Consumption	Middle-Aged Adult Women (MAW)		0.014	
		p-value	1.000	
	Older Adult Women (OAW)		-0.060	-0.075
		p-value	0.631	0.436
Monthly frequency of consumption	Middle-Aged Adult Women (MAW)		-0.615	
		p-value	1.000	
	Older Adult Women (OAW)		0.423	1.038
		p-value	1.000	0.900
Quantity consumed in grams	Middle-Aged Adult Women (MAW)		-66.936	
		p-value	1.000	
	Older Adult Women (OAW)		-90.990	-24.054
		p-value	0.930	1.000
Daily consumption per capita in grams	Middle-Aged Adult Women (MAW)		-15.986	
		p-value	1.000	
	Older Adult Women (OAW)		0.057	16.043
		p-value	1.000	1.000

* = Statistically significant differences

Table 4 shows the consumption frequencies of berries of each age group. The results show that berries consumption frequency of YAW and MAW are mainly into a mid-scale (1-3 times a month to once a week) whereas OAW consumption are skewed towards lower frequencies, since 40% of these women never consume berries. In the three age groups, daily consumption, from 1 to 3 times, is represented by less than 8% of responders.

Table 4. Frequency of Consumption of Berries in Women by Age Group

Frequency of consumption	Young Adult Women (YAW)		Middle-Aged Adult Women (MAW)		Older Adult Women (OAW)	
	n	%	n	%	n	%
Never	32	28.32	27	35.06	20	40
1-3 time a month	27	23.89	14	18.18	9	18
1 time a week	25	22.12	15	19.48	8	16
2-4 time a week	22	19.47	18	23.38	7	14
5-6 time a week	2	1.78	1	1.30	2	4
1 time a day	3	2.66	2	2.60	3	6
2-3 time a day	2	1.78	0	0	1	2

3.2 Reasons of Berries Consumption

The main reasons of consumption for which the women consumers said to ingest berries, were liking and the effects that this fruits bring to their health, including the nutritional properties such as antioxidants, their content in vitamins, fiber, among others. Some women expressed within this reason, that their intake was due to the anti-aging effects of these red fruits and its capabilities to prevent diseases such as cancer and diabetes mellitus. The rest of the reasons for consumption expressed were incorporated in "other reasons" and included consumption for availability at home or in the market, because they are necessary for some culinary preparations and because they are given the product because someone in the family works in greenhouses producing berries.

As it is shown in Table 5, it was found that the principal reason why YAW eats berries is because they like them. More than 50% of women of this age group consume berries because this reason, and only 14.81% eat them for their nutritional, anti-aging or health benefits. As age advances, reasons of consumption changes, since 26% of MAW prefer to eat berries because of their proprieties than for their taste. When woman reaches 56 years old, the reasons of consumption changes even more, and from the half of the YAW who prefer to eat berries for their taste, only 33.33% of OAW, consume them for this reason, as the most important motive for consume them are the properties that these foods can bring to their health and nutrition (36.67%), including their content in antioxidant which was a highly mentioned factor among this group of women.

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Spearman's rank correlation showed a low positive correlation between age and liking berries in YAW. Same size correlation was found in other reasons of consumption for YAW. A moderate positive correlation was find in OAW who consumes berries because they like them and this size correlation was also obtained in women of this group who said to eat berries because of their nutritional, health or anti-aging proprieties. In no case the correlation was strong enough.

Frequencies of participants by reason of consumption did not showed correlation, in fact, a negative correlation was identified in the case of OAW. ANOVA test showed that the grams of daily per capita consumption of berries due to their liking presented statistically significant differences between the groups (0.002*). This means that it is verified that age, besides of modify the reason of consumption also change the amount of consumption.

Table 5. Reasons of Consumption of Berries in Women by Age Group and Their Daily Consumption per Capita in Grams

		Young Adult Women (YAW)	Middle-Aged Adult Women (MAW)	Older Adult Women (OAW)	
Reason of consumption					ANOVA
Liking	n	41	22	10	0.449
	%	50.63	44	33.33	
	DCPC	24.28	22.43	23.62	0.002*
	SD	47.21	28.26	30.58	
	rho	0.396[b]	0.039[a]	0.640[c]	
	p	0.012*	0.864	0.046*	
Health, nutritional or antiaging effects	n	12	13	11	0.378
	%	14.81	26	36.67	
	DCPC	38.13	28.85	25.24	0.863
	SD	81.56	28.19	32.35	
	rho	-0.139[a]	0.143[a]	0.588[c]	
	p	0.700	0.655	0.044*	
Other reasons	n	28	15	9	0.589
	%	34.56	30	30	
	DCPC	38.45	35.64	70.28	0.392
	SD	50.42	70.86	121.14	
	rho	0.425[b]	0.174[a]	-0.066[a]	
	p	0.010*	0.289	0.773	
SCF	*rho*	0.072[a]	0.269[a]	-0.131[a]	
	p	0.523	0.059	0.498	

DCPC: Daily consumption per capita in grams; SD = Standard deviation; *rho* = Spearman's rank

correlation; *p* value from Spearman's rank correlation; ANOVA = *p* value from Analysis of Variance test between age groups by frequency of participants and DCPC in each reason of consumption; A value of p <0.05 was considered significant. SCF = Spearman correlation's in frequencies of participants; * = Statistically significant differences; [a] = negligible correlation (0.00 to 0.30 and 0.00 to -0.30), [b] = low positive correlation (0.30 to 0.50), [c] = moderate positive correlation (0.50 to 0.70), [d] = high positive correlation (0.70 to 0.90), [e] = very high positive correlation (0.90 to 1.00), according with Mukaka (2012).

Table 6 presents a multiple comparison Bonferroni test in reasons of berries intake and daily consumption per capita in grams, between the age groups. This was due to the identification of statistically significant differences between women who said they consumed berries due to liking. Statistically significant differences were identified between daily per capita consumption of YAW and OAW (0.011*) and of MAW and OAW (0.002*) in this intake reason. In the other variables, as in the ANOVA test, no statistically significant differences were identified.

Table 6. Multiple Comparison Bonferroni Test in Reasons of Berries Consumption in Women by Age Group and Their Daily Consumption per Capita in Grams

				Young Adult Women (YAW)	Middle-Aged Adult Women (MAW)
Liking	Consumption	Middle-Aged Adult		-0.094	
		Women (MAW)	*p-value*	0.640	
		Older Adult Women		-0.051	0.042
		(OAW)	*p-value*	1.000	1.000
	Daily consumption per capita in grams	Middle-Aged Adult		-39.925	
		Women (MAW)	*p-value*	0.741	
		Older Adult Women		135.822	175.748
		(OAW)	*p-value*	0.011*	0.002*
Health, nutritional or antiaging effects	Consumption	Middle-Aged Adult		0.083	
		Women (MAW)	*p-value*	0.661	
		Older Adult Women		0.083	0
		(OAW)	*p-value*	0.719	1.000
	Daily consumption per capita in grams	Middle-Aged Adult		-6.192	
		Women (MAW)	*p-value*	1.000	
		Older Adult Women		17.045	23.237
		(OAW)	*p-value*	1.000	1.000
Other reasons	Consumption	Middle-Aged Adult		-0.017	
		Women (MAW)	*p-value*	1.000	

	Older Adult Women		-0.142	-0.125
	(OAW)	p-value	0.932	1.000
Daily	Middle-Aged Adult		10.446	
consumption	Women (MAW)	p-value	1.000	
per capita in	Older Adult Women		-56.053	-66.5
grams	(OAW)	p-value	0.694	0.568

* = Statistically significant differences

4. Discussion

In first instance, it could seem that the consumption of berries is not related to the age of the women, since no correlations were found between the intakes and frequencies of consumption and the age. In addition, having found that the amount of YAW that consume berries has a trend in a greater consumption than OAW, could indicate that age is not an important factor in the consumption of these fruits and that in fact, there are more young women who consume berries in comparison with those who are older. However, interesting patterns of intake were identified. When women is younger consumes around 89 grams by day, but as age increase, consumption decrease more than 16 grams, nonetheless, when women reaches a higher age, above 56 years old, the consumption returns to 89 grams. Now, what is interesting in this patterns is the reason why women is eating this fruits.

When women is between 18 and 35 years old, liking berries result to be the most import reason for consuming them, however, as age increase, reasons of consumption changes, and get closer to a constantly worry for improve health, prevent chronic disease and delay aging. This coincide with the results of Chambers, Lobb, Butler, & Traill (2008) since, like them, it was identified that the older participants (60+ years old in their case) were more likely to make food choices based on health considerations, compared with younger women.

Likewise, the fact that oldest women consume berries mainly due to their nutritional properties, coincides with studies carried out in places such as Germany and United Kingdom, where the population refers concern about eating foods that provide health benefits (Farruggiaa, Crescimannoa, Galatia, & Tinervia, 2016; Huntley, 2009). In this sense, it can be affirmed that in Mexico, as the age increases, berries consumption revolve more around the health and nutrition than their taste, but the quantities and frequency of consumption are low, since as it was possible to verify, berries are consumed mainly occasionally in the three age groups studied. However, in spite of the low amounts of consumption, the results showed that statistically the per capita daily consumption of berries is different between the age groups depending of the reason of consumption, especially in the liking reason. Thus, although not completely, this study can find similarity to the one referred by Gibson, Wardle and Watts (1998) who mentioned that beliefs and attitudes about the relationship between diet and disease, have an important influence on food consumption. But nevertheless, although the concern for health, nutrition and anti-aging leads OAW to resume the consumption that was observed in the YAW group,

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this motivation is not enough to consume berries every day.

According to Brug et al. (1995), Laaksonen et al. (2016) and Roininen et al. (1999) the sensory characteristics of food and especially its taste and satisfaction, can be considered as one of the key factors in the acceptance of food. As well as the preference for certain food (Awuni, Kye-Duodu, Duodu, Zotor, & Ellahi, 2018). In short, this pattern was identified in the three age groups, however, it was much more important in YAW and MAW, due to in OAW liking berries took second place, preferring to consume them for their nutritional, health or anti-aging properties. In YAW and MAW liking berries was more important than their properties, to consume them, same as in the studies of Holm and Kildevang (1996) and Wardle (1993); even though authors such as Laaksonen et al. (2016), Tang, Kälviäinen and Tuorila (2001) and Viljanen, Heiniö, Juvonen, Kössö and Puupponen-Pimiä (2014) claim that the chemical components contained in berries (such as phenolic compounds and organic acids) induce an acidity that has a strong impact on their sensory quality, which affects the acceptance of consumption and may have a negative influence on the acceptation. However, according to Laaksonen, Ahola and Sandell (2013) for some, this may be a positive feature to some extent, which could be the case of YAW.

As mention, when age increases, the importance given to the flavor of the berries diminishes and they are consumed for their properties. According to Pohjanheimo and Sandell (2009) and Verbeke (2006) consumers who consider health as an important reason for choosing food and in order to obtain a benefit to their health, can accept more bitter flavors, compared to people who consider the comfort, taste and familiarity of food, more important than the benefit that these can provide to their health and that are not willing to choose healthiness over the taste of the product. In this sense, it is confirmed that age is a factor that marks a trend toward the flavors go to second term by preferring to prevent diseases and slow aging through the consumption of berries. Contributing to this, it has been reported that older women are more attached to a diet than younger women (Lietchy, 2012), regardless of its taste.

Kaume, Gbur, DiBrezzo, Howard and Devareddy (2014) suggest that consuming 45 grams of berries daily, like blackberry for 9 months, can provide certain health benefits, such as prevent bone loss induced by smoking in postmenopausal women, however, the results of the present study are far from this consumption, but why, if per capita daily consumption indicates more than 73 grams in all groups? Even though daily consumption per capita of the three age groups analyzed in this study could suggest that this ration is exceeded, it is important to remember that we talk about averages and when frequency of consumption is analyzed as an isolated variable, the daily consumption turn to be occasional, as the frequency of intake does not exceeded 6 times per month, although when consumed, ingested amounts are higher than 300 grams, i.e., greater than 1 cup of 250 grams, according with the SMAE (Pérez et al., 2014).

So far, the consumption of berries has shown to provide multiple benefits, especially to old adult women. In this specific age group, berries are of great help delaying the onset of cardiovascular diseases and cancer; help to improve memory and avoid cognitive problems in this period where these

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functions decline (Huntley, 2009). In accordance with Shukitt-Hale, Lau and Joseph (2008) early nutritional interventions with berries may even prevent or delay the onset of diseases such as Alzheimer's disease, because they can reduce oxidative stress and inflammation. As well, berries consumption help control body weight (Bertoia et al., 2016), and also, it has been even found that berries prevent and help in the treatment of viral diseases such as influenza (Gramza-Michałowska et al., 2017). Due to this, consumption in OAW should be promoted, because statistically, it turned out to be the age group that consumes less berries (60% of participants in this age range). To this point, in first world countries, such as Finland, Berries are part of traditional diets (Heinonen, 2007), nevertheless, in Mexico the consumption of berries is in a gradual process of addition to the diet, due to the important increase that has had its agricultural production (Housni el al., 2018).

5. Conclusions

Although it might seem that the consumption of berries is independent of age, this study shows an interesting relationship between them. While the daily amounts of intake are statistically equal in the three groups, descriptive analysis showed that although MAW consumption is lower compared to YAW, when women are reaching a stage of older adulthood, consumption returns to the levels observed in the younger ages, but the consumption motives diverge. To be more specific, the main motives switch from the pleasant flavor of the berries to those related to the potential of berries to delay the onset of chronic diseases and to slow down aging. From these findings, we conclude that age is a factor that influences the decisions of berries consumption. Also, it was found that age actually modify the daily per capita ingested amounts depending of the reason why are ingested, especially in liking. However, nutritional programs to promote the consumption of these fruits in the category of OAW are needed, since currently, only 60 percent of the group consumes them.

When consumption frequency is considered as a single variable, we find that consumption is only occasional; on average, women of all groups consume berries less than 5.6 times a month, that is, less than twice a week. For this reason, future studies evaluating the consumption of berries, or food in general, should consider both the quantity and the frequency of consumption as isolated and joint variables, for example, expressing the data of each one, but also including per capita daily consumption, obtained from these data. In Mexico, one of the world's top producers of berries (Housni et al., 2018), the advertising of the attributes of berries and the implementation of nutritional education programs are needed to increase their consumption levels. These will benefit all adult women, and especially those reaching the stage of older adulthood.

References

Aiyer, H., Srivani, R., & Gupta, R. (2011). Chemopreventive Effects of Berries and Berry Components in Animal Models: Prevention of Estrogen-Mediated Mammary Tumors in ACI Rats by Berries. In N. P. Seeram, & G. D. Stoner (Eds.), *Berries and Cancer Prevention* (pp. 163-187). USA: Springer.

Arganini, C., Saba, A., Comitato, R., Virgili, F., & Turrini, A. (2012). Gender Differences in Food Choice and Dietary Intake in Modern Western Societies. In J. Maddock (Ed.), *Public Health - Social and Behavioral Health* (pp. 83-102). Croatia: InTech. Retrieved from http://www.intechopen.com/books/public-health-social-and-behavioral-health/gender-differences-in-foodchoice-and-dietary-intake-in-modern-western-societies

Awuni, T. K., Kye-Duodu, G., Duodu, C., Zotor, F. B., & Ellahi, B. (2018). Knowledge and Determinants of Fruit and Vegetable Consumption among Adults in Hohoe Municipality, Ghana. *Food Science and Nutrition Studies*, *2*(1), 1-11. https://doi.org/10.22158/fsns.v2n1p1

Bennett, E. V., Clarkea, L. H., Kowalski, K. C., & Crocker, P. R. E. (2017). "I'll do anything to maintain my health": How women aged 65-94 perceive, experience, and cope with their aging bodies. *Body Image*, *21*, 71-80. https://doi.org/10.1016/j.bodyim.2017.03.002

Bertoia, M. L., Rimm, E. B., Mukamal, K. J., Hu, F. B., Willett, W. C., & Cassidy, A. (2016). Dietary flavonoid intake and weight maintenance: Three prospective cohorts of 124086 US men and women followed for up to 24 years. *British Medical Journal*, *352*(17), 1-7. https://doi.org/10.1136/bmj.i17

Brug, J., Debie, S., van Assema, P., & Weijts, W. (1995). Psychosocial determinants of fruit and vegetable consumption among adults: Results of focus group interviews. *Food Quality and Preference*, *6*(2), 99-107. https://doi.org/10.1016/0950-3293(95)98554-V

Chambers, S., Lobb, A., Butler, L. T., & Traill, W. B. (2008). The influence of age and gender on food choice: A focus group exploration. *International Journal of Consumer Studies*, *32*(4), 356-365. https://doi.org/10.1111/j.1470-6431.2007.00642.x

Devore, E. E., Kang, J. H., Breteler, M. M. B., & Grodstein, F. (2012). Dietary Intakes of Berries and Flavonoids in Relation to Cognitive Decline. *ANNALS of Neurology*, *72*, 135-143. https://doi.org/10.1002/ana.23594

Farruggiaa, D., Crescimannoa, M., Galatia, A., & Tinervia, S. (2016). The quality perception of fresh berries: An empirical survey in the German market. *Agriculture and Agricultural Science Procedia*, *8*, 566-575. https://doi.org/10.1016/j.aaspro.2016.02.075

Fraser, G. E., Welch, A., Luben, R., Bingham, S. A., & Day, N. E. (2000). The Effect of Age, Sex, and

35

Education on Food Consumption of a Middle-Aged English Cohort—EPIC in East Anglia. *Preventive Medicine*, *30*(1), 26-34. https://doi.org/10.1006/pmed.1999.0598

Gibson, E. L., Wardle, J., & Watts. (1998). Fruit and Vegetable Consumption, Nutritional Knowledge and Beliefs in Mothers and Children. *Appetite*, *31*(2), 205-228. https://doi.org/10.1006/appe.1998.0180

Gramza-Michałowska, A., Sidor, A., & Kulczynski, B. (2017). Berries as a potential anti-influenza factor—A review. *Journal of Functional Foods*, *37*, 116-137. https://doi.org/10.1016/j.jff.2017.07.050

Heinonen, M. (2007). Antioxidant activity and antimicrobial effect of berry phenolics—A Finnish perspective. *Molecular Nutrition & Food Research*, *51*, 684-691. https://doi.org/10.1002/mnfr.200700006

Holcomb, C. A. (1995). Positive Influence of Age and Education on Food Consumption and Nutrient Intakes of Older Women Living Alone. *Journal of the American Dietetic Association*, *95*(12), 1381-1386. https://doi.org/10.1016/S0002-8223(95)00365-7

Holm, L., & Kildevang, H. (1996). Consumers' Views on Food Quality. A Qualitative Interview Study. *Appetite*, *27*, 1-14. https://doi.org/10.1006/appe.1996.0029

Housni, F. E., Lares-Michel, M., Aguilera, C. V. G., Guźar, I., Bracamontes, D. H., & Michel, N. R. M. (2018). Impacto de la producción de berries sobre el comportamiento alimentario en una población de Jalisco, México. *Revista Mexicana de Trastornos Alimentarios*, *9*(1). http://dx.doi.org/10.22201/fesi.20071523e.2018.1.463

Huntley, A. L. (2009). The health benefits of berry flavonoids for menopausal women: Cardiovascular disease, cancer and cognition. *Maturitas*, *63*(4), 297-301. https://doi.org/10.1016/j.maturitas.2009.05.005

Jaeger, S. R., Axten, L. G., Wohlers, M. W., & Sun-Waterhouse, D. (2009). Polyphenolrich beverages: Insights from sensory and consumer science. *Journal of the Science of Food and Agriculture*, *89*(14), 2356-2363. https://doi.org/10.1002/jsfa.3721

Kaume, L., Gbur, E. E., DiBrezzo, R., Howard, L. R., & Devareddy, L. (2014). Antioxidant-rich berries exert modest bone protective effects in postmenopausal smokers without improving biomarkers of bone metabolism. *Journal of functional foods*, *9*, 202-210. https://doi.org/10.1016/j.jff.2014.04.025

Laaksonen, O., Ahola, J., & Sandell, M. (2013). Explaining and predicting individually experienced liking of berry fractions by the hTAS2R38 taste receptor genotype. *Appetite*, *61*, 85-96. https://doi.org/10.1016/j.appet.2012.10.023

Laaksonen, O., Knaapila, A., Niva, T., Deegan, K. C., & Sandell, M. (2016). Sensory properties and consumer characteristics contributing to liking of berries. *Food Quality and Preference*, *53*, 117-126. https://doi.org/10.1016/j.foodqual.2016.06.004

Lehtonen, H.-M., Suomela, J.-P., Tahvonen, R., Yang, B., Venojärvi, M., Viikari, J., & Kallio, H. (2011).

36

Different berries and berry fractions have various but slightly positive effects on the associated variables of metabolic diseases on overweight and obese women. *European Journal of Clinical Nutrition*, *65*, 394-401. https://doi.org/10.1038/ejcn.2010.268

Lietchy, T. (2012). Yes, I worry about my weight…but for the most part I'm content with my body: Older women's body dissatisfaction alongside contentment. *Journal of Women and Aging*, *24*, 70-88. https://doi.org/10.1080/08952841.2012.638873

Macedo-Ojeda, G., Vizmanos-Lamotte, B., Márquez-Sandoval, Y. F., Rodríguez-Rocha, N. P., López-Uriarte, P. J., & Fernández-Ballart, J. D. (2013). Validation of a semi-quantitative food frequency questionnaire to assess food groups and nutrient intake. *Nutrición Hospitalaria*, *28*(6), 2212-2220.

Mink, P. J., Scrafford, C. G., Barraj, L. M., Harnack, L., Hong, C., Nettleton, J. A., & Jacobs, D. R. (2007). Flavonoid intake and cardiovascular disease mortality: A prospective study in postmenopausal women. *The American Journal of Clinical Nutrition*, *85*(3), 895-909. https://doi.org/10.1093/ajcn/85.3.895

Mukaka, M. M. (2012). Statistics Corner: A guide to appropriate use of Correlation coefficient in medical research. *Malawi Medical Journal*, *24*(3), 69-71.

O'connor, J. (2012). *News is "berry" good for some women*. McKnight's Assisted Living. Retrieved from http://www.web.a.ebscohost.com.wdg.biblio.udg.mx:2048/ehost/pdfviewer/pdfviewer?vid=3&sid=ec35f5f4-c8e8-4bc2-9acc-a0d23abdeeea%40sessionmgr4010

Official Gazette of the Federation. Regulation of the General Health Law on Health Research. (2014). Mexico: Secretariat of Parliamentary Services. Retrieved from http://www.tegra.com.mx/images/files/reglamentos/89.pdf Accessed 6 February 2018.

Pérez, A. B., Palacios, G. B., Castro Becerra, A. L. & Flores, G. I. (2014). *Mexican system of equivalent foods*. Mexico: Promotion of Nutrition and Health, National Institute of Medical Sciences Salvador Zubirán and Ogali.

Petry, M. N. (2002). A Comparison of Young, Middle-Aged, and Older Adult Treatment-Seeking Pathological Gamblers. *The Gerontologist*, *42*(1), 92-99. https://doi.org/10.1093/geront/42.1.92

Pohjanheimo, T., & Sandell, M. (2009). Explaining the liking for drinking yogurt: The role of sensory quality, food choice motives, health concern and product information. *International Dairy Journal*, *19*(8), 459-466. https://doi.org/10.1016/j.idairyj.2009.03.004

Prättälä, R., Paalanen, L., Grinberga, D., Helasoja, V., Kasmel, A., & Petkeviciene, J. (2006). Gender differences in the consumption of meat, fruit and vegetables are similar in Finland and the Baltic countries. *European Journal of Public Health*, *17*(5), 520-525. https://doi.org/10.1093/eurpub/ckl265

Roininen, K. et al. (2001). Differences in health and taste attitudes and reported behavior among Finnish, Dutch and British consumers: A cross-national validation of the Health and Taste Attitude Scales (HTAS). *Appetite*, *37*(1), 33-45. https://doi.org/10.1006/appe.2001.0414

37

Roininen, K., Lähteenmäki, L., & Tuorila, H. (1999). Quantification of consumer attitudes to health and hedonic characteristics of foods. *Appetite*, *33*(0232), 71-88. https://doi.org/10.1006/appe.1999.0232

Ros, E., Tapsell, L. C., & Sabaté, J. (2010). Nuts and Berries for Heart Health. *Current Atherosclerosis Reports*, *12*, 397-406. https://doi.org/10.1007/s11883-010-0132-5

Samieri, C., Sun, Q., Townsend, M. K., Rimm, E. B., & Grodstein, F. (2014). Dietary flavonoid intake at midlife and healthy aging in women. *American Journal of Clinical Nutrition*, *100*(6), 1489-1497. https://doi.org/10.3945/ajcn.114.085605

Service tax administration (SAT). Minimum wages 2018. (2018). Retrieved February 4, 2018, from http://www.sat.gob.mx/informacion_fiscal/tablas_indicadores/paginas/salarios_minimos.aspx

Shukitt-Hale, B., Lau, C. F., & Joseph, J. A. (2008). Berry Fruit Supplementation and the Aging Brain. *Journal of Agricultural and Food Chemistry*, *56*, 636-641. https://doi.org/10.1021/jf072505f

Tang, X., Kälviäinen, N., & Tuorila, H. (2001). Sensory and hedonic characteristics of juice of sea buckthorn (Hippophae rhamnoides L.) origins and hybrids. *LWT—Food Science and Technology*, *34*(2), 102-110. https://doi.org/10.1006/fstl.2000.0751

Verbeke, W. (2006). Functional foods: Consumer willingness to compromise on taste for health? *Food Quality and Preference*, *17*(1-2), 126-131. https://doi.org/10.1016/j.foodqual.2005.03.003

Viljanen, K., Heiniö, R.-L., Juvonen, R., Kössö, T., & Puupponen-Pimiä, R. (2014). Relation of sensory perception with chemical composition of bioprocessed lingonberry. *Food Chemistry*, *157*, 148-156. https://doi.org/10.1016/j.foodchem.2014.02.030

Wardle, J. (1993). Food choices and health evaluation. *Psychology & Health*, *8*(1), 65-75. https://doi.org/10.1080/08870449308403167

Willet, W. (2013). Food frequency methods. In W. Willet (Ed.), *Nutritional epidemiology* (pp. 70-95). New York: Oxford University Press.

Willis, L. M., Shukitt-Hale, B., & Joseph, J. A. (2009). Recent advances in berry supplementation and age-related cognitive decline. *Current Opinion in Clinical Nutrition and Metabolic Care*, *12*(1), 91-94. https://doi.org/10.1097/MCO.0b013e32831b9c6e

Yang, B., & Kortesniemi, M. (2015). Clinical evidence on potential health benefits of berries. *Current Opinion in Food Science*, *2*, 36-42. https://doi.org/10.1016/j.cofs.2015.01.002