

Design of a Modified Hamburger with Various Health Benefits

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Abstract

The World Health Organization has warned of the health risk posed by the consumption of processed meat products. There is increasing scientific evidence about the protective effect on various chronic diseases from the consumption of certain elements present in vegetables such as polyphenols. Hamburgers are universally consumed and widely accepted by the population but are considered to be a processed product. Designing healthier modified burgers can be a public health measure.

A literature search was conducted on the pubmed database according to PRISMA guidelines and a number of plant ingredients were selected on the basis of this. In two groups of volunteers (one group consumed a normal but unsalted and low-fat burger and the other a modified burger) the effect on levels of glycosylated hemoglobin, LDL-cholesterol, triglycerides and ultra-sensitive C-reactive protein was studied over several weeks (by consuming several servings of burger per week).

Statistically significant results were obtained (in individuals consuming the modified hamburger) in reduction of LDL-cholesterol, glycosylated hemoglobin, triglycerides and ultra-sensitive C-reactive protein.

Incorporating a modified hamburger enriched with antioxidant and fiber-rich plant elements into the regular diet may result in various cardiovascular and metabolic benefits.

Keywords: Hamburger; Cardiovascular; Hemoglobin

Introduction

Traditionally and from a nutritional point of view, the hamburger has been considered a food with a high energy density that also provides salt, certain additives and saturated fat. It also falls into the category of processed meat and it should not be forgotten that the International Agency for Research on Cancer, which is an agency dependent on the World Health Organization, warned that the consumption of processed meat products and red meat can significantly increase the risk of cancer has taken many by surprise. This is not new since it cannot be forgotten that in 2007 the World Cancer Research Fund warned that it was advisable to avoid processed meat and also to limit red meat [1] and years later (2011) it ratified it again [2].

The consumption of processed and red meat (and especially processed meat) increases the risk of mortality from any cause (including cancer) and from cardiovascular and metabolic diseases etc... [3].

Studies have found a convincing association between consumption of processed meat and colorectal, esophageal, stomach and bladder cancer [4].

It has also been associated with an increased risk of diabetes and metabolic syndrome [5,6].

Regarding the risk of cancer, some studies suggest that it matters how we cook them and that high cooking temperature could influence this. Cooking at high temperatures or with food in direct contact with a flame or a hot surface, such as a barbecue or a frying pan, could be harmful [7]. On the other hand, apart from a diet rich in antioxidants, some studies suggest that calcium and alpha-tocopherol may be helpful in preventing colorectal cancer [8].

In terms of quantity, it appears that each 50 gram portion of processed meat consumed daily increases the risk of colorectal cancer by approximately 18%. Current WCRF - AICR recommen-

dations are to minimize processed meat [9]. The Spanish Agency for Food Safety and Nutrition advises that consumption of red and processed meats should not be "more than twice a week". Even so, meat is an interesting food that has also played an interesting role in human nutrition [10].

Of course, when we talk about hamburgers as processed meat we are referring to many of the traditional hamburgers, because in reality a hamburger may not be processed and be healthy, it all depends on its composition. And in this study we propose a hamburger made with minced meat from skinless chicken breast or turkey breast, mixed with aromatic herbs, spices, a little bit of onion and prepared in the oven, grill or broiler with hardly any fat (the little fat used will be extra virgin olive oil) can be a good option, but it is not a good option (for regular consumption) a beef or pork burger made with minced meat from high fat content fractions, mixed with fat, a lot of salt, additives...

Background

After carrying out an exhaustive bibliographic review of published studies on the development of nutritionally modified hamburgers with added substances such as fiber, spices, aromatic herbs, nuts... it has been possible to verify that low-fat hamburgers exist (even on the market) or have been developed, hamburgers to which some substance has been added in search of some extra benefit such as rosemary or nuts, even hamburgers with their modified lipid content. However, there are no burgers on the market that combine a reduction in sodium, a greater richness in potassium, a reduction in saturated fat, the presence of beta-glucan, an increase in polyunsaturated fat, and the presence of fruits, nuts, spices and aromatic herbs.

News

After a review in the bibliography of almost three months, several ingredients were selected and in finished doses to be part of the hamburger; looking for concrete physiological effects beneficial for our organism.

The proposed product is made from skinless chicken breast without preservative additives (because the product as it is made is preserved in deep-freezing). Skinless chicken breast was chosen because of its lower fat content and because the intake of poultry meat is negatively associated with some types of cancers and is not related to increased cardiovascular and/or metabolic risk. In fact, when red meat and processed meat are replaced by other protein-rich foods such as poultry meat, rabbit meat or fish, there is a lower risk of metabolic syndrome [4]. To avoid the use of preservative additives, the burger as produced is kept in deep-freezing.

Oat fiber rich in oat beta-glucan is added to the burger at a dose of 3 grams per serving (we consider two 100-gram burgers per serving) because beta-glucan helps reduce cholesterol and glucose [11] and in fact the EFSA (European Food Safety Authority) allows, at these doses, to include nutritional claims on the label. The EFSA,

after evaluating different studies, considers that it has been proven that beta-glucan can contribute to the maintenance of normal glucose and cholesterol levels in the blood, and even reduce them, provided that a series of requirements are met.

In the case of cholesterol the product should contain a minimum of one gram of beta-glucans and it should also be indicated that the effect is achieved if at least 3 grams of beta-glucans are consumed daily. To report benefits related to lowering blood glucose elevations (of particular interest in people with diabetes or at risk of diabetes, such as people with obesity), the food should contain a minimum of 4 grams of beta-glucans from oats or barley per 30 grams of carbohydrate.

The burger also contains sesame, which is rich in fibre, phytochemicals and polyunsaturated fats and has been linked to a protective effect from a cardiovascular and metabolic point of view [12]. This effect of sesame is shared [13] by the rest of more plant components (spices...) included in the formulation.

General objective

Design a healthy hamburger.

Specific objectives

- Remove the elements that do not make it healthy in the hamburger and add other ingredients with beneficial effects for the body.
- Check in human volunteers the impact on cardiovascular and metabolic markers of the consumption of a hamburger.

Materials and Methods

A bibliographic search was carried out in the pubmed database according to the guidelines of the PRISMA guidelines and based on this a series of vegetable ingredients were selected (more than 20).

It has started with healthy individuals, overweight men and women, without drug intake or chronic diseases and have been randomized into 2 groups of 17 volunteers each. All volunteers ingested 6 servings (200 grams) of hamburger per week for 4 weeks. One group ingested the hamburger under study and the other a normal chicken breast burger without any of the components under study. Blood tests were performed at the beginning and at the end and the result of certain variables (LDL-cholesterol, Glycosylated Hemoglobin, Ultrasensitive C-reactive Protein and Triglycerides) was compared.

Experimental design, statistical studies

Two groups: normal hamburger (2) and spicy hamburger (1) groups

- Variables
 - LDL-initial and final cholesterol
 - Initial and final glycosylated hemoglobin
 - Initial and final ultrasensitive c-reactive protein
 - Initial and final triglycerides
- Factor: Sex (1: man; 2: woman)
- The sample is 34 subjects.

Results

Descriptive statistics of the 4 variables in the initial and final moments: global, by experimental groups and by sexes.

Global descriptive

The minimum and maximum values and the means and SD of each variable in the total sample are observed.

Descriptive statistics					
	N	Minimum	Maximum	Means values (MV)	Standard deviation (SD)
LDL Chol initial	34	56,40	210,20	127,2488	34,93059
LDL Chol final	34	63,50	202,40	120,4118	29,24701
Hemo Initial	34	25,00	38,00	31,6176	2,98496
Hemo Final	34	25,00	39,00	31,2647	3,36928
CR Protein initial	34	,17	7,35	1,8397	1,74840
CR Protein final	34	,12	5,42	1,4553	1,38231
TG Initial	34	48,00	211,00	89,7059	36,86711
TG Final	34	42,00	170,00	80,0588	27,89259
N valid (according to the list)	34				

Table 1

There is a decrease in the initial moment at the end of the mean values of the variables LDL Col, ProteínaCREac and TGC. Later we will analyze if these decreases are statistically significant and occur in the two experimental groups and if sex modifies this result.

Descriptive by groups: Spicy and normal

Increases in the mean values from the initial moment to the end are observed in all the variables in the Normal Experimental Group. Later we will analyze if these decreases are statistically significant.

Descriptive statistics						
Group		N	Minimum	Maximum	MV	SD.
Spicy	LDL Chol initial	17	95,20	210,20	135,1588	36,36033
	LDL Chol final	17	86,90	191,50	117,9000	27,15115
	Hemo Initial	17	27,00	38,00	31,2353	2,51320
	Hemo Final	17	25,00	37,00	29,5294	2,85302
	CR Protein initial	17	,17	6,31	1,7488	1,70228
	CR Protein final	17	,12	3,46	,8712	,84771
	TG Initial	17	54,00	211,00	93,2941	42,83510
	TG Final	17	43,00	128,00	72,2353	21,26185
	N valid (according to the list)	17				

Table 2

Comparison of initial values by group and by sex

In order to compare different experimental groups and check if the differences are statistically significant, the subjects should start from similar values at the initial moment in the variables studied. Let's see if this is true in this sample of data.

The statistical test for independent samples U of Mann Whitney indicates that there are no significant differences between the initial values of each experimental group in any of the variables studied.

Report					
Group		LDL chol initial	HEMO initial	CR protein initial	TG initial
Spicy	N	17	17	17	17
	MV	135,1588	31,2353	1,7488	93,2941
	SD	36,36033	2,51320	1,70228	42,83510
Normal	N	17	17	17	17
	MV	119,3388	32,0000	1,9306	86,1176
	SD	32,58099	3,42783	1,84107	30,67752

Table 3

Analysis of the normality in the distribution of the variables under study (Kolmogorov Smirnov test)

This test tells us if the data of the variables follow a normal distribution or not and allows us to choose the best means comparison test to study whether the differences between the initial and final moments are statistically significant or not.

Variable	Kolmogorov-Smirnov	Statistical test chosen
LDL Cholesterol	0,002	Wilcoxon Signed Rank Test
Glycosylated hemoglobin	0,2	Paired T-test
Ultrasensitive c-reactive protein	0,001	Wilcoxon Signed Rank Test
Tryglicerides	0,1	Paired T-test

Table 4

Influence of the treatment in the variables: Comparisons between initial and final groups in the results of each variable in each experimental group

We will use the tests indicated in the previous section.

The level of statistical significance considered to establish a difference as significant will be that of sig. 0.05 or less.

Initial and final LDL-cholesterol

The LDLCOL variable has suffered a decrease from the initial moment (135 ± 36) to the end (117 ± 27) in the Spicy group. In the Normal group the variable has increased slightly.

Descriptive statistics				
Group		N	MV	SD
Spicy	LDL chol initial	17	135,1588	36,36033
	LDL chol final	17	117,9000	27,15115
Normal	LDL chol initial	17	119,3388	32,58099
	LDL chol final	17	122,9235	31,83780

Table 5

The Wilcoxon test produces a calculation of the positive ranges (number of cases that have increased from initial to final) and negative (number of cases that have decreased from initial to final) to perform the significance analysis. In the Spicy group there are more negative ranges than positive ones. Therefore the difference in the value of LDLCOL between the initial and final moments is significant (sig. 0.0001). On the other hand, in the Normal group almost the same cases of positive and negative range are appreciated, so the change in addition to small is not significant (sig. 0.46).

Initial and final glycosylated hemoglobin

The Statistical Test Paired T-Test has shown that the decrease in glycosylated Hemoglobin values between the initial and final moments in the Spicy group is very significant (sig. 0.0001). Likewise, the increase in glycosylated Hemoglobin values between the initial and final moments in the Normal group is significant (sig. 0.02).

Ranks			
Group			N
Spicy	LDL chol initial - LDL chol final	Negative ranks	17 ^a
		Positive ranks	0 ^b
		Draws	0 ^c
		Total	17
Normal	LDL chol initial - LDL chol final	Negative ranks	8 ^a
		Positive ranks	9 ^b
		Draws	0 ^c
		Total	17

Table 6

Statistics of related samples				
Group		MV	N	SD
Spicy	Glycosylated hemoglobin initial	31,2353	17	2,51320
	Glycosylated hemoglobin final	29,5294	17	2,85302
Normal	Glycosylated hemoglobin initial	32,0000	17	3,42783
	Glycosylated hemoglobin final	33,0000	17	2,97909

Table 7

Initial and final ultrasensitive c-reactive protein

The variable Protein C Reactive has suffered a decrease from the initial moment (1.74 ± 1.7) to the end (0.87 ± 0.84) in the Spicy group. In the Normal group the variable has increased slightly.

Descriptive statistics				
Group		N	MV	SD
Spicy	Ultrasensitive c-reactive protein initial	17	1,7488	1,70228
	Ultrasensitive c-reactive protein final	17	,8712	,84771
Normal	Ultrasensitive c-reactive protein initial	17	1,9306	1,84107
	Ultrasensitive c-reactive protein final	17	2,0394	1,58030

Table 8

The Wilcoxon test produces a calculation of the positive ranges (number of cases that have increased from initial to final) and negative (number of cases that have decreased from initial to final) to perform the significance analysis. In the Spicy group there are more negative ranges than positive ones. Therefore the difference in the value of C-Reactive Protein between the initial and final moments is significant (sig. 0.001). On the other hand, in the Normal group almost the same cases of positive and negative range are appreciated, so the change in addition to small is not significant (sig. 0.98).

Initial and final triglycerides

The Paired T-test statistical test has shown that the decrease in TGC values between the initial and final moments in the Spicy group is significant (sig. 0.02). The increase in TGC values between

Ranks			
Group			N
Spicy	CR protein final - CR protein initial	Negative ranks	16 ^a
		Positive ranks	1 ^b
		Draws	0 ^c
		Total	17
Normal	CR protein final - CR protein initial	Negative ranks	9 ^a
		Positive ranks	8 ^b
		Draws	0 ^c
		Total	17

Table 9

the initial and final moments in the Normal group is not significant (sig. 0.74).

Statistics of related samples				
Group		MV	N	SD
Spicy	TG Initial	93,2941	17	42,83510
	TG Final	72,2353	17	21,26185
Normal	TG Initial	86,1176	17	30,67752
	TG Final	87,8824	17	31,97632

Table 10

Discussion

Although there is always talk of the health risk associated with the consumption of processed meats, including hamburgers, it is reasonable to suggest that the problem is not the fact that it is a hamburger but that the ingredients from which such products are made are not usually the most interesting from a nutritional point of view. We see how, indeed, when a burger is made with quality ingredients, such as skinless chicken breast, and with a series of vegetable elements rich in phytochemicals... not only does its regular consumption not pose problems from a cardiometabolic point of view, but it can even cause beneficial physiological effects and we could venture that it may have a certain preventive effect. This is to be expected since chicken meat is not a problem and certain vegetable elements such as spices, aromatic herbs, beta-glucan, nuts... have proven positive effects on our organism.

Conclusion

- Making a hamburger without preservatives additives, and enriched in fiber, antioxidants etc.. is a feasible option.
- The usual consumption of a serving of spicy hamburger (6 servings per week) reduces statistically significant LDL-cholesterol, Triglycerides, Ultrasensitive Reactive Protein C and Glycosylated Hemoglobin.

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