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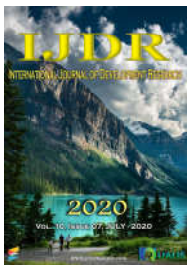

RESEARCH ARTICLE OPEN ACCESS

FREQUENT INGESTION OF ANIMAL FAT AND RISKS ASSOCIATED WITH CONSUMPTION

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ABSTRACT

Meat and meat products have high consumption rates in world population. Many of these products have a high content of fats that contribute to their sensory characteristics, but if consumed in excess they are associated with development of obesity, metabolic process, cardiovascular diseases, among others. Aim of this work was to quantify total lipid content in products derived from cured meat products, to correlate them with health problems associated with their consumption. Thirty cured meat products from different commercial brands were selected and stored at refrigeration temperature (4 °C) until moment of their analysis. Total lipids were extracted and analyzed using Bligh-Dyer methodology where a mixture of solvents is used to extract lipids. Lipid contents ranging from 6.68 to 48.35% (w/ w) were found; many of products had a fat content above that established by Brazilian legislation. Due to various risks associated with excessive consumption of fat, there is a need to reduce the frequent consumption of these products by general population.

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INTRODUCTION

Meats and meat products are consumed worldwide due to their high, varied nutritional value, being a source of proteins, minerals, variable proportion of lipids (Borges; Santana, 2019). These products are considered an excellent source of zinc, heme-iron, bioavailable B vitamins, essential amino acids (Pereira; Vicente, 2013; Boher, 2017). Several researchers have dedicated themselves to analyzing nutritional content of meat products (Pereira; Vicente, 2013; Barretto, Barretto, Telis-Romero. 2016; Lima *et al*., 2017; Hammad *et al*., 2020), this knowledge has served as warning against dangers of high consumption of red meats and meat products. Lipid content of beef varies from 2.5% to 24% (w / w), its composition is mainly related to factors such as age, sex, physiological status, genotype and diet (Dias *et al*., 2008; Guyon; Meynier; Lamballerie, 2016). Excess of lipids can contribute to modification of their sensory characteristics due to natural processes of lipid oxidation resulting in changes in taste, color of meat and meat products. In addition, lipid oxidation generates production of toxic and carcinogenic products known as malonaldehydes (Lima-Junior, 2013; Borges; Santana, 2020). Some lipid oxidation products have been reported to contribute to aging, cancer and cardiovascular disease.

Cholesterol oxidation can also occur generating cholesterol oxides that constitute a health problem due to its role in arteriosclerotic plaques, also as mutagenic, carcinogenic and cytotoxic (Guardiola *et al*., 1996; Flores *et al*., 2019). Frequent consumption of foods high in lipids, Trans and saturated fat is related to elevated plasma LDL cholesterol, increased cardiovascular risk. Type of fat ingested can also influence other risk factors, such as insulin resistance and blood pressure (Santos *et al*., 2013; Borges; Santana, 2019). In addition, presence of excess salt, carcinogenic additives such as sodium nitrite in cured products have already been linked (Borges *et al*., 2020a; Borges *et al*., 2020b; Borges *et al*., 2020c). Aim of this work was to quantify total lipid content in products derived from cured meat products and to correlate them with health problems associated with high consumption rate.

MATERIALS AND METHODS

Study location: Meat derivatives samples were purchased in the cities of Petrolina-PE and Juazeiro-BA. Petrolina is municipality in state of Pernambuco, located in San Francisco Valley region, neighboring municipalities of Juazeiro and Sobradinho. Located at 380 meters of altitude, latitude 9° 23' 39" South, longitude 40° 30' 35" West. Juazeiro is a city in state of Bahia. Neighboring municipalities of Petrolina and Sobradinho, located 5 km south-east of Petrolina. Situated at

an altitude of 369 meters, latitude: 9° 26' 18" South, longitude: 40° 30' 19" West.

Product samples: Thirty types of meat products of different commercial brands were purchased with 15 days of storage. Following were purchased: four chicken sausages, two pepperoni sausages, one ham sausage, four Italian type salami, two paios, six hamburgers, two sirloin, four mortadella. Conservation during this time was carried out in refrigerated environment, at temperature of 4° C. Samples were ground individually in meat grinder at time of analysis.

Lipid composition* of *meat products: Lipids were determined by Bligh-Dyer (1959) using mixture of methanol, chloroform and distilled water, followed by 30 minute stirring on a mechanical stirrer (Shaker SK 180-Pro). Then chloroform and 1.5% sodium sulfate solution were added. Samples were capped, stirred for 2 minutes, left to rest to separate the layers naturally in separating funnel or centrifuge at 1000 rpm for 2 minutes to accelerate separation. From bottom layer, 15 mL were removed and placed in a 30 mL tube. Approximately 1 g of anhydrous sodium sulfate was added, tubes were capped and shaken to remove traces of water that were entrained in pipetting of lower layer. They were quickly filtered through small funnel with filter paper. Solution obtained must be clear. Exactly 5 mL of filtrate was measured (volumetric pipette), poured into 50 mL beaker previously tared. Beakers were placed in oven at 80 °C until solvent evaporated (15-20 minutes), cooled in desiccator and weighed on analytical balance.

(L%) = (((lipids in 5mL) x Theoretical weight of the sample) / Actual weight of the sample) x100 (eq. 1)

Theoretical sample weight = 4.0 g

Statistical analysis: Statistical analysis was performed by One-way ANOVA, using STATISTICA® 7.0 program, values considered significant with $p > 0.05$. All determinations were performed in triplicate (N = 3), data were expressed average and standard deviation. Results were compared using Tukey test to identify existence of significant differences between test results, with significance level of 95% for each evaluated parameter.

RESULTS AND DISCUSSION

Table 1 contains results of quantification of total lipids in cured derivatives of meat products. It can be observed that meat products analyzed follow same pattern as fresh meat, with high amount of fat, mainly saturated, which in medium, long term can contribute to development of obesity and cardiovascular diseases (Cuppari, 2005; Lehninger, Nelson, Cox, 2006; Hautrive; Marques; Kubota, 2012). As shown in Table 1, levels of total lipids varied depending on product analyzed, brand purchased: chicken sausages (10.43-30.21%), pepperoni sausages (36.14-36.20%), Italian salami (36.15-37.05%), paio (6.68-9.76%), hamburgers (17.46-35.49%), mortadella (24.32-29.61%), loin (15,53-20.78%), ham (15.26-18.51%). Statistical analysis indicated that there is significant difference between samples. When analyzing samples it is noted that some foods maintain a pattern in lipid content but in others choice of brands directly influences amount of fat consumed during day.

Table 1. Content of total lipids in meat sausages

Test	Product	Brand	Total Lipids (%)
1	Chicken sausage	A	14.23t ± 0.01
2	Chicken sausage	B	30.21g ± 0.02
3	Chicken sausage	C	10.43v ± 0.01
4	Chicken sausage	D	14.33t ± 0.01
5	Shank sausage	E	16.51r ± 0.08
6	Chicken sausage	F	11.72u ± 0.01
7	Pepperoni sausage	A	36.14c ± 0.01
8	Pepperoni sausage gold	F	36.2c ± 0.01
9	Italian salami	F	36.3c ± 0.02
10	Italian salami	H	37.05b ± 0.02
11	Italian salami	A	37.05b ± 0.01
12	Italian salami	E	36.15c ± 0.01
13	Paio	I	48.35a ± 0.01
14	Paio	J	23.40m ± 0.01
15	Hamburger	L	22.67n ± 0.01
16	Hamburger	M	17.46q ± 0.01
17	Hamburger	N	32.40e ± 0.01
18	Hamburger	O	30.66f ± 0,01
19	Hamburger	F	29.15i ± 0.01
20	Hamburger	P	35.49d ± 0.01
21	Mortadella	D	24.32l ± 0.01
22	Mortadella	Q	28.11j ± 0.01
23	Mortadella	E	27.24k ± 0.11
24	Mortadella	R	29.61h ± 0.01
25	Mortadella	A	27.19k ± 0.10
26	Loin	E	20.78o ± 0.01
27	Loin	S	15.53s ± 0.23
28	Ham	T	18.51p ± 0.01
29	Ham	E	15.26s ± 0.30
30	Ham	A	16.59r ± 0.08

*Values expressed as average ± standard deviation followed by equal lowercase letters in same columns do not differ statistically at 5% level (Tukey test).

Normative Instruction N°. 4 of March 31, 2000 (Brazil, 2000), which establishes maximum permitted limit of 30% of fat samples in meat products although each product may have specific fat range (below this value) that can be added. Allowance of these fat contents in meat products is allowed because this constituent contributes to development of sensory and quality attributes such as: softness, juiciness, texture, flavor, appearance and yield. However, it is possible to reduce fat content by replacing non-meat ingredients with combination of other ingredients that keep emulsion stable (Shimokomaki *et al*., 2016). Behling *et al*. (2014) when analyzing nutritional chemical composition of three bologna formulations incorporated with wheat found lipid content of 14.10, 14.51 and 15.59% (w / w). Commercial brands of bologna analyzed showed higher levels of lipids than those found by these researchers, although by incorporating wheat they make product functional with a higher fiber content, which contributes to well-being, health of individuals. According to authors cited, adequate fiber intake prevents or alleviates problems such as constipation, obesity, colorectal cancer, diverticulitis, diabetes, cardiovascular diseases associated with high blood levels of cholesterol, triglycerides. Ferreira and Silva. (2018) when analyzing sausages purchased in market in Uberaba, MG, Brazil. They found fat content between 29.50 -32.48%. In this study, contents ranging from 17.50-35.90% were found. Standard value for fat in beef hamburger (BRAZIL, 2000) is maximum of 23% or g 100 g^{-1}. This indicates that four of six samples analyzed are at odds with legislation. Zanardi *et al*. (2002) found high values of total lipids in sausage ranging from 32 to 43%. Novelli *et al*. (1998) found that levels of total lipids varied from 26 to 36% in Milano type salami and from 23 to 35% in bologna. Baggio. (2004) obtained levels of total lipids ranging from 3 in ham to 25% in Italian type salami when they analyzed samples of processed beef meat products (meatball, hamburger "jerked

beef"), pork (Tuscan sausage, ham lower ham) and mixed meat composition (hot dog sausage, mortadella Italian type salami). Lower values were obtained by Lercker and Rodriguez-Estrada. (2000) in salami, with levels varying from 19 to 25% (w / w). This data on excess lipids in products so consumed by general population is worrisome because according to World Health Organization (WHO, 2017), cardiovascular diseases (CVD) is leading cause of death worldwide. It is estimated that 17.7 million people died of cardiovascular disease in 2015, representing 31% of all deaths in world, rate practically identical to that found in Brazil. Of these deaths, it is estimated that 7.4 million are due to cardiovascular disease and 6.7 million are due to stroke. More than three quarters of deaths from cardiovascular disease occur in low- and middle-income countries. Of 17 million premature deaths (people under the age of 70) without communicable diseases, 82% occur in low-income countries, 37% are from cardiovascular diseases. According to WHO, most cardiovascular diseases can be avoided by addressing behavioral risk factors that apply to general population, such as: tobacco use, unhealthy diets, obesity, lack of physical activity, harmful use of alcohol. In recent years, consumers are becoming more informed, more critical of food they eat, quality and quantity of fat in their diet (Webb; O'Neill, 2008). Correlation between the consumption of animal fats and health complications (cardiovascular diseases) was studied; recommendations include limiting fats from products derived from animals (Lawrence, 2013; Webb; O'Neill, 2008; Willett, 2012). When assessing quality of fats in diet, two most characteristic effects of fats in animal products are increase in amount of saturated fats, presence of cholesterol compared to fats in products of plant origin (Woodgate; Van Der Veen, 2014).

CONCLUSION

Although consumption of animal protein is important to have nutritional balance, excessive consumption can contribute to several diseases. Lipid contents ranging from 6.68 to 48.35% (w / w) were found; many of the products had fat content above that established by Brazilian legislation. Excessive consumption of meat products should be avoided because, in addition to excess fat, these products may contain excess sodium, carcinogenic additives such as sodium nitrite and generate during malonaldehyde storage.

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