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Monosodium Glutamate In Chicken Meat Products

Research Article

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Abstract

Monosodium glutamate (MSG) is an excellent flavor enhancer that can be found in a variety of foods. Its determination is crucial because it is linked to the sanitary quality of food and human health. This study aimed to assess Food additive monosodium glutamate (MSG) levels in chicken meat products. Fifty random samples of chicken meat products were estimated by the HPLC-ultraviolet/diode array method. In general, there was no significant variation in MSG levels between samples ($P > 0.05$). The highest mean ± SE MSG concentration (mg/gm.) was found in chicken nuggets (3.95 ± 0.51) than in chicken burgers (1.85 ± 0.28). At the same time, chicken sausage samples were the highest (2.75 ± 1.05), followed by marinated chicken meat slices (1.73 ± 0.22), and finally chicken kofta (1.47 ± 0.85) mg/gm. of MSG. Fortunately, current estimated MSG contents in the examined products were less than the permissible limits set by E.S.The U.S. Food and Drug Administration agreed that the amount of Food additive monosodium glutamate that caused responses in humans varied from 0.5 to 3 grams soa typical serving of a foodstuff with added MSG has less than 0.5 grams of MSG. but more attention and strict regulations to reduce the risk of health hazards of these additives with accumulative exposure. A joint effort by authorities is needed to establish the corrected and safe doses of MSG in human.

Keywords: Chicken Meat Products; HPLC; Monosodiumglutamate; O-Phthaldialdehyde; Flavor Enhancers.

Introduction

Significant changes in the global chicken meat industry have occurred in recent years, mostly as a result of worldwide population expansion. These facts might be one of the causes for the increased popularity of processed chicken meat products such as canned and ready-to-eat meals.

The use of preservatives, flavor enhancers, and other additives in modern cuisine has become commonplace. Over a century ago, tasting salt, or Food additive monosodium glutamate, was created by the Japanese. The flavor profile known as Umami, which has a meaty flavor, is one of the most prevalent amino acids in nature. It is present in a heterogeneous group in a wide range of foods as a flavor enhancer (E621), either as hydrolyzed protein or as pure Food additive monosodium salt. (Zealand, 2003 and Shaltout, 2020) .MSG is also utilized as a food preservative due to its antioxidant properties. (Mortensen et al., 2017 and Shaltout et al., 2018).

MSG is utilized in animal feed, food processing, restaurants, industries, and residences by both consumers and institutional food service providers. It may now be found in hundreds of foods all around the world, and its use is only growing. At the same time, during the previous two decades, health concerns regarding the products' widespread usage have surfaced. despite the fact that practically all legal regimes do not prohibit people from tasting salt.The Federation of American Societies for Experimental Biology (FASEB) reported in 1995 that MSG access in dosages ranging from 0.5 to 3 g can cause a transient MSG syndrome (Chinese restaurant syndrome) (Singh, 2005 and Shaltout et al., 2019). Various studies have hinted at possible toxic effects related to obesity, CNS disorders, and disruptions in adipose tissue physiology, CRS, hepatic damage, and reproductive malfunctions. (Niazet al., 2018 and Shaltout et al., 2022). Furthermore, MSG is a controversial substance in terms of its harmful consequences following long-term dosing. (Moldovanet al., 2021 and Shaltout et al., 2020) . So,

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this work was designed to estimate the MSG in different chicken meat products sold in Egypt by using HPLC-UV/DAD. With regard to its significant contribution to human health.

Materials and Methods

Collections of Samples

A total of fifty random samples of frozen chicken nuggets & burger and also marinated chicken meat slices , sausage &kofta (10 of each). The collected samples were preserved in an icebox then transferred to lab without undue delay and subjected to analyze MSG as follow:-

Food additive Monosodium glutamate in chicken meat samples by using HPLC-UV/DAD (Soysevenet al., 2021)

Reagents and chemicals: The HPLC grade water, analytical grade Food additive monosodium glutamate (MSG) reference standard from Sigma Aldrich company , hydrochloride acid (HCl), phthaldialdehyde powder (OPA), methanol (MeOH), diethylether, ophthalaldehyde-Ready To Use (OPA-RTU) reagent, 2-mercaptoethanol, Na2B4O7, and Na2HPO4 (all of which were HPLC grade ultra pure) .

Preparation of stock solution of MSG

In HPLC grade water at a concentration of 10 mg/ml. from stock prepare intermediate solution at a concentration of 1 mg/ml .this intermediate solution was used in preparation of working standard in blank minced chicken meat at concentration of 0.5 , 1 , 2 , 5 , 10 , 20 mg/gm. then the spiked sample (working standard) was extracted and prepared as mentioned below.

Extraction of MSG from samples

Samples preparation: weight (1 g) and homogenized with 100 mL of 0.10 N HCI solution. The resulting suspension was sonicated for 20 min. For extraction process, 50 mL of the prepared solution was taken over by adding 50 mL of diethyl ether and mixing thoroughly; then, the diethyl ether was removed. The MSG extraction approach was carried out using a previously published method. by(Croitoruet al. 2010). An extraction process was used to remove fatty acids. Each prepared sample was filtered through a 0.22 μm PVDF membrane filter and transferred to a vial after the aqueous phase was collected. All samples were derivatized with the OPA-RTU solution.

Samples Derivatisation: To start, exactly 27 mg of OPA powder was added to 1 mL of HPLC grade MeOH and the mixture was stirred by vortex for 30 seconds to prepare the o-ph-thaldialdehyde (OPA) derivatising agent. The mixture was then carefully added to 5 mL of mercaptoethanol solution. The OPA derivatisation solution was then prepared by adding 9 mL of Na2B4O7 buffer (0.10 M sodium tetraborate, pH = 9.30). (Zandyet al., 2017). The OPA Ready To Use (OPA-RTU) solution (purchased from Sigma-Aldrich) was then used to derivatize MSG. Finally, both derivatising solutions were used, and the same results were obtained. To save time and simplify each analysis, the OPA-RTU derivatization reagent was used instead of the OPA solution in the following experiments. (Demirhanet al., 2015). For this reason, the OPA-RTU contains 1 mg of o-phthaldialdehyde per mL solution, with 2-mercaptoethanol serving as the sulphydryl moiety. The 100 μL portions of the generated MSG working standard solution were taken and added to the HPLC vial, and 900 μL of OPA-RTU was added on every part, and the mixture was stirred well with vortex for five minutes. All standard working solutions were filtered through a 0.22 m PVDF membrane filter.

Apparatus and chromatographic condition

HPLC device (Shimadzu, Nexera, I LC–2040C 3D model liquid chromatography, Japan) connected to a Shimadzu Nexera–I 2040C 3D Model UV/DAD detector. Chromatographic condition was carried out on a C18 column (RestekRaptorTM) with a mobile phase of 10 mM phosphate buffer solution (PBS) (pH = 5.90): MeOH (75:25, v/v) at a flow rate of 0.6 mL min—1. The injection volume was 20 μL, the needle was washed with water-MeOH (70:30, v/v), and the detection was performed at 336 nm.

Statistical Analyses

A one way variance analysis (ANOVA) was used to analyze the data using SPSS (version 20;IBM, Chicago ,IL,USA) . The significant difference at ($P > 0.05$)there was no significant variation in MSG levels between samples.

Result

Results for various chicken meat products samples

As shown in table (1), results revealed that , the Food additive monosodium glutamate levels (mg/gm.) were varied in the examined chicken meat products , chicken nuggets samples were the highest concentration levels in chicken products with a mean± S.E value of (3.95± 0.51) in range of (3.02) to (4.8) followed by (1.85± 0.28)in range of (1.45) to (2.4) in chicken burger . Moreover , in chicken products, chicken sausage samples mean was (2.75± 1.05) in range of (0.78) to (4.38) followed by (1.73± 0.22) in range of (1.3) to (2) in marinated chicken meat slices and (1.47± 0.85)in range of (0.41) to (3.17) in chicken kofta samples. on the other hand , the percentage of non-prescribed MSG on the labels were 30% , 30% , 0% , 0% and 0% in chicken nuggets, chicken burger , chicken sausage , marinated chicken meat slices and chicken kofta , respectively as shown in table (2).

The calibration curve was created by plotting the areas of the analyst chromatograms against the concentration values of the MSG standard solutions. The mean values of the results obtained from three times repeated analyses of the standard solutions prepared in six different concentrations were used to achieve linearity. The R2 value was determined to be 0.9999. The proximity of this value to one indicates that the correlation was satisfactory and applicable for this analytical method. As shown in Fig. (2).

Discussion

Monosodium glutamate is one of the most popularly used taste enhancers in the food market, where its consumption has already been increasing, raising concerns about possible harmful effects. (Moldovan et al., 2021). The food and drug administration (FDA) certified it safe for restricted use and noted some potential ad-

Table 1. Food additive Monosodium glutamate values (mg/gm.) of different examined chicken meat products (n=10of each).

Products	Minimum	Maximum	Mean ± S.E
Chicken Nuggets	3.02	4.81	3.95 ± 0.51
Chicken Burger	1.45	2.4	1.85 ± 0.28
chicken Sausage	0.78	4.38	2.75 ± 1.05
marinated chicken meat slices	1.3	2	1.73 ± 0.22
chicken Kofta	0.41	3.17	1.47 ± 0.85

Table 2. Prescribed and non-prescribed MSG values on labels of different examined chicken meat products(n=10 of each).

Products	Prescribed on labels		Non-prescribed on labels	
	No.	%	No.	%
Chicken Nuggets	7	70	3	30
Chicken Burger	7	70	3	30
chicken Sausage	10	100	0	0
marinated chicken meat slices	10	100	0	0
chicken Kofta	10	100	0	0
Total	44	88	6	12

Figure 1. Chromatogram of MSG at a concentration of 20 mg/gm. In blank minced chicken meat.

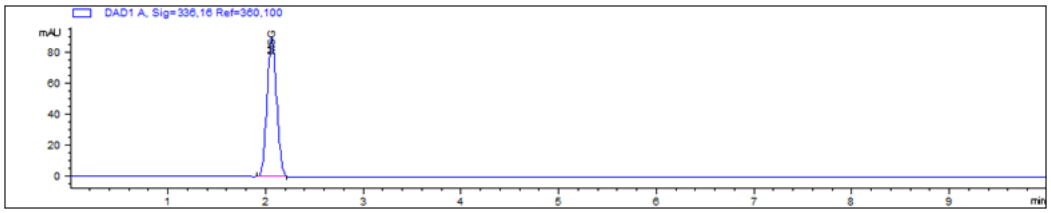
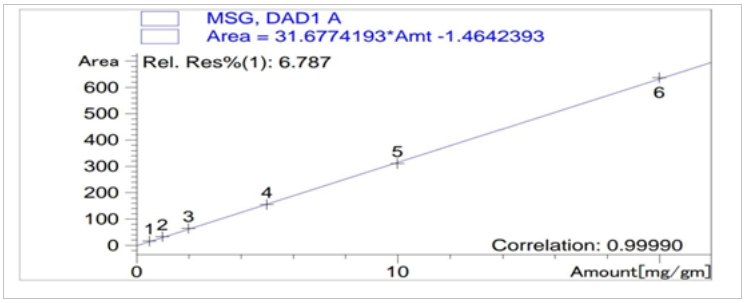


Figure 2. Standardcurve of MSG area versus concentrations.



verse effects associated with greater MSG use. Circulatory, cardiac, muscular, gastrointestinal, and neurological problems are more prevalent. (Kazmiet al., 2017).Thus, MSG would be directly liable for genetic damage. It might alter the genetic material and, in turn, cause free radicals to cause harm by damaging the cell's nuclear component.(Imam, 2019).

According to the obtained results in table (1), there were variations in MSG values in the examined chicken meat products. Whereas chicken nuggets had the highest concentration mean value of MSG, followed by chicken sausage, chicken burger, marinated chicken meat slices, and chicken kofta samples, and chicken kofta samples had the lowest. In comparison with previous researches, we found results of chicken nuggets were lower than that recorded by (Shaltout, 2022) (210.8 mg/gm.). Also, chicken burgers' mean values were higher than those detected by (Rodriguez et al., 2003) (1.457 mg/gm.), (Afraa et al., 2013 and Shaltout et al., 2014) (1.6 mg/gm.) and (Hassan et al., 2018 and shaltout et al., 2022) (1.399 mg/gm.). On the other hand, MSG in chicken sausage samples was higher than the results illustrated by (Hassan et al., 2018) (1.959 mg/gm.) and (Baciuet al., 2020) (0.178 mg/gm.) but lower than that recorded by (Rohdes et al., 2015) (5.4 mg/gm.). Moreover, in chicken kofta samples, MSG levels were lower than those recorded by both (Hassan et al., 2018 and Shaltout., 2022)(1.849 mg/gm.) and (Soysevenet al., 2021) (21.3 mg/gm.)

The amount of MSG in each product varies. Some have not been altered in terms of flavor. Moreover, the ideal concentration for its impact varies between individuals.(Wijayasekara and Wansapala, 2017).

Monosodium glutamate must be included on the product packaging label, according to the FDA.(Moldovanet al., 2021). Given

this concern and the current results of table (2), about 12% of all examined samples, including 30% of both chicken nuggets and burgers, contained MSG not prescribed on the label. These results disagreed with the recommendation of E.S (2010) also.

As a result, toxicity studies identified the No Observed Adverse Effect Level (NOAEL) level of 3200 mg of MSG/Kg bw (body weight/day) extrapolated from the Acceptable Daily Intake (ADI) dose (30 mg/Kg bw per day) according to official data from the European Food Safety Authority (EFSA).(Moldovanet al., 2021)Previously, JECFA attested to an ADI of MSG ranging from0 and 120 mg/kg bw.(Mortensen et al., 2017).

Although MSG's documented toxicity was minimal after short-term dosing (5000 mg/Kg bw/day) (EFSA, 2019) at long term consumption, because of the possibility of a cumulative component, knowledge concerning its influence on the organism is ambiguous. Unfortunately, there have been no limits to the amount of MSG that can be purchased. Furthermore, because daily MSG intake seems difficult to measure due to unknown levels of additives prevalent in fast food menus and processed foods, it can be very easy to reach the level of abusive usage. (Siddiqua, 2017 and Wijayasekara&Wansapala , 2017) . Moreover, monosodium glutamate is a controversial substancewhen it comes to toxic effects following a long period of administration. (Moldovan et al ., 2021).

Conclusion

The highest concentration levels of MSG were in chicken nuggets and the lowest one was in chicken kofta. On the other hand, because the dosage is not precisely and completely described, it is hard work for a person to calculate the actual amount of food additive MSG consumed. Furthermore, food manufacturers are not required to write the quantity on the label. The regulations need harmonization of accepted doses of food additive MSG based on more scientific studies.

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