

## Revelation and Determination of 3-Monochloropropane-1,2-Diol (3-Mcpd) in Bread from Modern Bakeries in Khartoum State, Sudan

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Eissa Ibrahim Bahar Adam<sup>1</sup>, Yousif Mohamed Ahmed Idris<sup>1</sup>,

Abdalbasit Adam Mariod\*<sup>2,3</sup>

<sup>1</sup>Department of Food Sci. & Technology, College of Agricultural Studies, Sudan University of Sci. & Technology, Khartoum North, Sudan

<sup>2</sup>College of Sciences and Arts-Alkamil, University of Jeddah, Alkamil, Saudi Arabia

<sup>3</sup>Indigenous Knowledge and Heritage Center, Ghibaish College of Science & Technology, Ghibaish, Sudan.

\*Corresponding author: basitmariod58@gmail.com

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### Abstract

This study was carried out for the revelation and determination of 3-Monochloropropan-1, 2 diol (MCPD) in bread from modern bakeries in Khartoum state, Sudan. Twenty five samples (25) of bread were collected from different modern bakeries of Khartoum, Khartoum Bahari and Omdurman, they include, round bread (13) samples and long bread (12) samples. The moisture content and oil content of samples were determined according to the AOAC method and the quantity of 3-MCPD by Gas Chromatography Mass Spectrometry (GC-MS) was investigated. 3-MCPD exposure for individual by body weight per day for adults and children was estimated. Moisture content in round bread ranged from 31.7% to 35.7%, and in long bread from 28.2% to 33.6%. Oil content in round bread ranged from 0.7955% to 0.9894% and oil content in long bread from 0.7684% to 1.005%. 3-MCPD was detected in round bread and long bread with a concentration of 0.15493-1.05873ppm to 0.11334-0.59644ppm, respectively, which were lower than that of European Commission Scientific Committee for Food Standardization. Exposure of adults and children to 3- MCPD upon consumption of bread is estimated to be (0.015446-0.031277µg/kg)-(0.002397-0.014118µg/kg)-(0.018039-0.036528µg/kg) and (0.002799-0.016488µg/kg) for adult and children, respectively. These exposure levels do not constitute a health risk.

**Keywords:** 3-Monochloropropan-1, 2 diol, round bread, long bread, Gas Chromatography Mass Spectrometry

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## **INTRODUCTION**

3-monochloropropane-1, 2-diol (3-MCPD) esters are food preparation contaminants found in vegetable oils and foodstuffs (Crews et al. 2013). The European commission scientific committee for food established maximum tolerable daily intake (TDL) for 3-MCPD of 2ug/kg of body weight per day, and the lowest observed effect at 0.1ug/kg body weight per day. Amounts of 3-MCPD measured in a bakery fat and/or retail soft dough biscuit were 1285 and 632ug/kg and consistent with amount reported previously, and the concentration of free 3-MCPD in bread samples was at interval <9-54.5ug/kg (Dolezal, et al. 2009). Hamlet et al. (2004), estimated 3-MCPD-esters in long bread most elevated levels were found in areas of the bread that accomplished the most noteworthy temperature, i.e the crust, and level expanded from 60-160ug/kg when the bread was long more than 40-120 seconds. The most elevated level of 3-MCPD-esters (6100ug/kg-1) was found in French fries (Svejkovska, et al. 2004).

In addition, domestic processing can create generous increments in the 3-MCPD substance of bread or cheddar (Breilling – utzmann et al. 2003). Stauf, et al. (2020) evaluated the content and formation of free and bound monochloropropanediol and bound glycidol in some bakery products include short bread. Their analytical screening revealed, that free 3-MCPD can be quantified in products with low water and fat content, which are produced using high baking temperatures. A few investigations on the component of the 3-MCPD arrangement have been performed (Hamlet et al., 2003; Muller, et al. 2005), and demonstrated that it is framed from glycerol or acylglycerols and chloride particles in heat prepared foods that contain fat with low water activity as expressed by Delezal, et al. (2009). In spite of the fact that the general degrees of 3-MCPD in baking items are moderately low, the elevated level of utilization of bread, and its extra development from longing, demonstrate that this staple food alone can be a critical dietary source of 3-MCPD (Breilling- Utzmann, et al. 2003).

Heat processing of lipids with added sodium chloride occurring 3-MCPD in the present of acid hydrolyzed vegetable protein, hydrolysis of 3-MCPD esters by lipases as can occur in baked bread (Baer, et al. 2010). Hamlet, et al. (2004), measured 3-MCPD-esters in long bread, highest levels were found in regions of the bread that attained the highest temperature, i.e the crust, and level increased from 60-160ug/kg when the bread was long over 40-120 seconds, the highest level of 3-MCPD-esters (6100ug/kg-1) was found in a sample of French fries Svejkovska, et al. (2004). Belkova et al. (2020) investigated the influence of dough composition on 3-MCPD esters, formation during bread toasting. They found that, toasting of bread for 2.5 min considerably enhanced the formation of acrylamide and 3-MCPD esters. 3-MCPD was detected and quantified by direct, and indirect methods e.g. derivatization and GC-MS analysis, DGF method C-VI 18 10, and SGS 3-in-1. In Sudan there is no data about the 3-MCPD in bread, although, Sudan consumes a large amount of bread and vegetable oils. And consequently detection and quantification of 3-MCPD in modern bakeries bread is important to evaluate the extent of potential health risk. The study aims to provide information about detection and quantification of 3-MCPD in modern bakeries bread in Khartoum state, Sudan, and assessment of the exposure levels of the population.

## **MATERIAL and METHODS**

### **Samples collection**

Twenty five samples of round and long bread were collected randomly from various bakeries of Sudan capital state (Khartoum, Khartoum Bahri and Omdurman). The samples were divided into two groups, (12 long breads and 13 round breads), 12 long breads were collected from different areas of Khartoum, 4 samples were collected from various bakeries Khartoum (Sharwani, Burri, Manshiya and Jabelawlya), 4 samples were collected from various bakeries of Khartoum Bahri (Dar alssam, Mazad, Danagla and Margania) and four sample were collected from Omdurman (Almulazmeen, Shuhada, Fetihaab and Shigla) and the second group is 13 samples round breads were collected from bakeries of Khartoum, Khartoum Bahari and Omdurman. Divided into the 5, 4, and 4 samples, respectively. Five samples from bakeries of Khartoum (Duyum east, Duyum west, Hila Jadida and Alsajana), four samples from bakeries of Khartoum Bahri (Kadaru, Al-uzba, Kobar, and Kafuri) and four samples from Omdurman bakeries (Salha, Jaddain North, Jaddain South, and Libya market).

### **Reagents and Chemicals for 3-MCPD**

NaCl (p.A), phenyl boronic acid ( $\geq 98\%$ , PBA), acetone, hexane, methyl tert-butyl ether (MTBE), methanol, and ethyl acetate (all suprasolv for GC) as well as  $\text{CH}_3\text{COOH}$  and  $\text{H}_2\text{SO}_4$  96%, were obtained from VWR (Damstadt, Germany).  $\text{CH}_3\text{NaO}$  (25% w/v in methanol), 3-monochloropropane-1, 2-diol (98%), and 3-methoxypropane-1, 2-diol (98%) were bought from Sigma Aldrich (Weinherin, Germany). A solution of 50  $\mu\text{L}$  of  $\text{H}_2\text{SO}_4$  in 5 mL of  $\text{CH}_3\text{OH}$  was arranged along these lines for change of glycidyl esters ( $\text{CH}_3\text{OH} / \text{H}_2\text{SO}_4$ ). 1, 2-dipalmitoyl 3-chloropropane and glycidyl palmitate were bought from Campro Scientific (Berlin, Germany). A NaCl solution (NaCl solution 20%) of 200 g/L was prepared in deionized water. The Derivatization reagent PBA was prepared by dissolving 5 g of PBA in 19 mL of acetone and 1.0 mL of deionized water.

### **Equipments**

Glass wool, Soxhlet, Mortar Pestle, Sensitive Balance, Vortex mixer (2500 rpm, 30 s), Micro pipette, Beakers, Volumetric flask And Gas Chromatography-Mass Spectrometry (GCMS) from Japan, Shimadzu Company.

### **Methods**

#### **Determination of moisture content**

Sample was weighted and then registered weigh of wet samples, dried at temperature ( $105^\circ\text{C}$ ) in oven for 6 hours and moisture content was determined according to AOAC method (2000).

#### **Extraction and determination of oil**

About 200g of dried bread was used to extract the oil following the AOCS Am 2-93 method (AOCS 2017) using Soxhlet apparatus. The extracted oil from all the samples, was kept in plastic bottles (polyethylene), and stored in freezer at temperature ( $-18^\circ\text{C}$ ), until analyzed.

### Analysis of 3-MCPD using PBA derivatization

Investigations were performed by Breitling-Utzmann, et al. (2004). The subjective and quantitative examination of the sample was done by utilizing GM/MS procedure model (GC/MS-QP2010-Ultra) from Japan, Shimadzu Company, capillary column (Rtx-5ms-30m×0.25 mm×0.25µm). The sample was infused by utilizing split mode, helium as the bearer gas went with stream rate 1.20 ml/min, the temperature program was begun from 100°C with rate 20°C/min to 160°C hold for 1.0 moment then the rate was changed to 5°C/moment to 180°C, at last, the rate was changed to 30°C/minutes arriving at 300 as definite temperature degree, the infusion port temperature was 320°C, the particle source temperature was 230°C and the interface temperature was 300°C. The example was broke down by utilizing SIM mode choosing m/z 91, 147, 196, the all out run time was 15 minutes, and results were recorded. At that point the measure of 3-MCPD was processed. Three tests of each sample were made.

### Concentration of 3-MCPD exposure assessment for adults and children

For estimation exposure of individual to concentration of 3-MCPD at specified point in a day, twenty breads were give (4-6g) oil, average weight of round bread (65g) and long bread (55g). Individual consumption per day in Sudan about 10 breads, for adults 18-20+ years was estimated, and 6 bread for children 14-15 years. Body weight for deterministic exposure estimates based on the WHO/JEFCA.(2007), simulated diets, mean body weight for adults 68.03kg and children 47.67kg. Concentration of 3-MCPD body weight per day for individual were determined (Vannoort and Thomson 2005).

## RESULTS and DISCUSSION

### Moisture content for round and long bread from the different bakeries

Table 1 reports the moisture content of round bread (RB) and long bread (LB) collected from different bakeries of Khartoum state (Khartoum, Khartoum Bahri and Omdurman), the ID number from 1-9 represents moisture content of bread collected from Omdurman, while ID number from 10-17 idealizes moisture content of bread collected from Khartoum and ID number from 18-25 represents moisture content of bread collected from Omdurman .There was no significant difference between all bread collected from different areas of Khartoum state. Lower moisture content in RB were 31.7%, while medial moisture content in round bread were 33.56% and higher moisture content in round bread were (35.8%). While the lower moisture content in long bread were 27.2%, medium moisture content in long bread was 31.02%, and higher moisture content in long bread were 33.6%. From this information moisture content in round bread higher than moisture content in long bread.

**Table 1.** Moisture and oil contents of round and long bread

ID	Samples	Moisture content (%)	Oil Content (%)
1.	Modern LB	31.9	0.768
2.	Modern LB	30.8	0.9465
3.	Modern LB	28.4	0.998

4.	Modern LB	33.1	0.9955
5.	Modern RB	34.4	0.7955
6.	Modern RB	34.1	0.9894
7.	Modern RB	33.4	0.9305
8.	Modern RB	33.7	0.9855
9.	Modern RB	31.7	0.907
10.	Modern RB	31.8	0.900
11.	Modern RB	33.4	0.9905
12.	Modern LB	33.6	0.7805
13.	Modern LB	31.9	0.8305
14.	Modern LB	28.8	0.9435
15.	Modern LB	28.2	1.005
16.	Modern RB	35.5	0.894
17.	Modern RB	35.7	0.8945
18.	Modern RB	33.6	0.905
19.	Modern RB	32.9	0.975
20.	Modern RB	33.3	0.9105
21.	Modern RB	32.8	0.944
22.	Modern LB	27.2	0.823
23.	Modern LB	32.8	0.833
24.	Modern LB	32.7	0.8305
25.	Modern LB	32.7	0.8785

### **Oil content for round and long bread from the different bakeries**

Table 1 shows the oil contents of round bread (RB) and long bread (LB) collected from different bakeries of Khartoum state (Khartoum, Khartoum Bahri and Omdurman), the ID number from 1-9 represents oil content of bread collected from Omdurman, while ID number from 10-17 idealizes oil content of bread collected from Khartoum and ID number from 18-25 represents oil content of bread collected from Omdurman. There was no significant difference between all bread collected from different areas of Khartoum state. Lower oil content in round bread (RB) was found to be 0.7955%, while medial oil content in round bread was 0.92% and higher oil content in round bread were 0.995%.

While the lower oil content in long bread as 0.894%, medial oil content in long bread were 0.894%, and higher oil content in long bread were 1.005%. And consequently, oil content in round bread was higher than oil content in long bread.

## DISCUSSION

Table 4 shows concentration of 3-MCPD in round bread oil, ranged from 0.15493 - 1.05873ppm, but find two samples were not detected, the main reason due to heat treatment with short time, food processing, and moisture content. Because, the concentration of 3-MCPD increased by temperature with time increased. And traditional of oil processing and less amount of sodium chloride were used. Dimensions (length, width, and thickness) with moisture content leads to increased of the concentration of 3-MCPD (if the moisture content and the length, width was high, bread needs long time with high temperature to matured). Lower concentration levels of 3-MCPD esters in round bread oil were 0,15493ppm, average concentration levels were (0.49825ppm), and higher concentration level was 1,05873ppm.

**Table 2.**shows concentration of 3-MCPD (ppm) in round bread oil

ID	Sample	Concentration of 3-MCPD (ppm) of oil	Concentration of 3-MCPD mg/kg of bread
1	S5/RB	0.52279	0.00188
2	S6/ RB	0.15493	0.00055
3	S7/RB	0.31573	0.00114
4	S8/RB	0.36274	0.00131
5	S9/ RB	0.34149	0.00123
6	S10/ RB	0.58253	0.00210
7	S11/ RB	0.28591	0.00103
8	S12/RB	1.05873	0.00382
9	S13/ RB	0.96438	0.00348
10	S18/RB	0.32869	0.00118
11	S19/ RB	0.23414	0.00084
12	S24/RB	N.D	ND
13	S25/RB	N.D	ND

S= Sample. R=Round. T=Long. B= bread

Table 2 shows concentration of 3-MCPD esters in long bread oil, was generally formed low, ranging from 0.11334ppm –0.667ppm.lower concentration of 3-MCPD esters were found in long bread oils, 0.11334ppm, average concentration level was 0.346472ppm, and higher concentration level was 0.66749ppm. From these concentrations result obtained it is consider no large difference between them, but find two sample were no detected, the main reason for difference quantity of 3-MCPD in long bread oil is due to the heat treatment processing, moisture content, oil content and type of oils, (refining, partially and traditional oil) used, bread color, and its dimensions (length width and thickness). Comparison between the quantity of 3-MCPD in long bread oil and round bread, showed that, the quantity of 3-MCPD esters in round bread oil was higher than the quantity in long bread oil. Because the average quantity of 3-MCPD in round bread oil were 0.49825ppm and average in long bread oil was 0.346472ppm, while higher concentration of 3-MCPD in round bread oil was 1.05873ppm and the higher concentration of 3-MCPD in long bread oil was 0.66749ppm and

lower concentration of 3-MCPD in round bread oil was 0.15493ppm and the lowest concentration in long bread oil was 0.11334ppm.

The main differences between concentrations of 3-MCPD in round bread and long bread, were mainly due to the heat treatment processing, moisture content, oil content and type of oils, ( refined, partially refined and traditional oil ) used, bread color ,and dimensions (length width and thickness).the temperature ,time ,length, width, moisture content and oil content in round bread oil were (250°C 7-8 minutes, 11-13cm, 4-5cm, 33.56%, and 0.924%), respectively, and brownish colour and the temperature, time ,length, width, moisture content and oil content in long bread oil were (250°C, 6-7 minutes, 20-25cm, 3-4cm, 31.02%, and 0.894%), respectively, and brownish colour. Comparison with previous studies (Dolezal, et al. (2005), and Divinova, et al. (2007), carried out for concentration of 3-MCPD in bread were formed to be ranged between 1.56-23.6mg/kg was higher than concentrations of 3-MCPD was found in round bread oil and long bread oil that ranged (0.11334-0.66749ppm) (0.000346-0.002039mg/kg) and (0.15493-1.05873ppm) (0.000559-0.003823mg/kg), respectively. While Kertisova, et al. (2009), reported values of concentration for bound 3-MCPD esters in bread crumb ranged from 1.56 to 21.13mg/kg of fat and concentration of 3-MCPD esters in bread crust ranged from 2.82 to 3.60 mg/kg of fat. Concentrations of 3-MCPD were found in round bread fat and long bread oil ranged 0.11334 to 0.66749ppm (i.e 0.000346-0.002039mg/kg) and from 0.15493 to 1.05873ppm (i.e 0.000559-0.003823mg/kg), respectively, is lowest than that reported.

Hamlet, et al. (2004), analyzed 3-MCPD-esters in long bread and, highest levels were found in regions of the bread that attained the highest temperature, i.e the crust , and level increased from 60-160ug/kg-1 when the bread was long over 40-120 seconds ,the highest level of 3-MCPD-esters (6100ug/kg-1) concentration of 3-MCPD were found in round bread fat and long brad oil range (0.113340.66749ppm) (i.e 0.000346-0.002039mg/kg) and (i.e 0.15493-1.05873ppm) (0.0005590.003823mg/kg), respectively, were increased by temperature and time increase.

**Table 3.** Concentration of 3-MCPD (ppm), in long bread oil

ID	Sample	Concentration of 3-MCPD(ppm)ofoil	Concentration of 3-MCPD mg/kg of bread
1	S1/Long Bread	0.56378	0.00172
2	S2/LongBread	0.37503	0.00114
3	S3/Long Bread	0.20270	0.00061
4	S4/LongBread	0.26577	0.00081
14	S14/LongBread	0.66749	0.00203
15	S15/Long Bread	0.59644	0.00182
16	S16/Long Bread	0.21776	0.00066
17	S17/Long Bread	0.29495	0.00090
20	S20/LongBread	0.16746	0.00051
21	S21/LongBread	N.D	ND
22	S22/LongBread	N.D	ND
23	S23/LongBread	0.11334	0.00034

Lower Concentration of 3-MCPD exposure for adults from round bread were (0.005345 $\mu\text{g}/\text{kg}$ ) body weight per day, higher concentration were (0.036528 $\mu\text{g}/\text{kg}$ ) body weight per day, and medium concentration of 3-MCPD exposure for Adults were (0.016171 $\mu\text{g}/\text{kg}$ ).

**Table 4.** Estimated quantity of 3-MCPD ( $\mu\text{g}/\text{kg}$ ) for body weight per day exposure for individual adults (Round bread oil).

ID	Name	Mean Adult Age	Body Weight	3-MCPD $\mu\text{g}/\text{kg}$ exposure
1	S5\RB	18-20	68.03	0.01803
2	S6\RB	18-20	68.03	0.00534
3	S7\RB	18-20	68.03	0.01093
4	S8\RB	18-20	68.03	0.01258
5	S9\RB	18-20	68.03	0.01178
6	S10\RB	18-20	68.03	0.02009
7	S11\RB	18-20	68.03	0.00988
8	S12\RB	18-20	68.03	0.03652
9	S13\RB	18-20	68.03	0.03327
10	S18\RB	18-20	68.03	0.01134
11	S19\RB	18-20	68.03	0.00807
12	S24\RB	18-20	68.03	ND
13	S25\RB	18-20	68.03	ND

Mean estimated quantity of 3-MCPD exposure for Adults = 0.016171 $\mu\text{g}/\text{kg}$ .

**Table 5.** Estimation of concentration of 3-MCPD ( $\mu\text{g}/\text{kg}$ ) exposure for adults from long bread.

ID	Name	Body Weight	Mean Adult Age	3-MCPD $\mu\text{g}/\text{kg}$ exposure
1	S1\TB	68.03	18-20	0.01392
2	S2\TB	68.03	18-20	0.00926
3	S3\TB	68.03	18-20	0.00565
4	S4\TB	68.03	18-20	0.00656
14	S14\TB	68.03	18-20	0.01648
15	S15\TB	68.03	18-20	0.01473
16	S16\TB	68.03	18-20	0.00537
17	S17\TB	68.03	18-20	0.00728



20	S20\TB	68.03	18-20	0.00413
21	S21\TB	68.03	18-20	ND
22	S22\TB	68.03	18-20	ND
23	S23\TB	68.03	18-20	0.00279

LB: long bread Mean estimated quantity of 3-MCPD exposure for adults = 0.0086234  $\mu\text{g}/\text{kg}$

Lower Concentration of 3-MCPD exposure for adults from long bread were 0.002799  $\mu\text{g}/\text{kg}$  body weight per day, higher concentration were 0.016488  $\mu\text{g}/\text{kg}$  body weight per day, and mean concentration of 3-MCPD exposure for adults were 0.0086234  $\mu\text{g}/\text{kg}$ .

Table 6 shows estimation of concentration of 3-MCPD ( $\mu\text{g}/\text{kg}$ ) exposure for children from round bread.

**Table 6.** shows estimated quantity of 3-MCPD ( $\mu\text{g}/\text{kg}$ ) for body weight per day exposure for individual children, (Round bread oil).

ID	Name	Mean kids Age	Body Weight	3-MCPD $\mu\text{g}/\text{kg}$ exposure
1	S5\RB	14-15	47.67	0.01544
2	S6\RB	14-15	47.67	0.00457
3	S7\RB	14-15	47.67	0.00935
4	S8\RB	14-15	47.67	0.01077
5	S9\RB	14-15	47.67	0.01008
6	S10\RB	14-15	47.67	0.01720
7	S11\RB	14-15	47.67	0.00846
8	S12\RB	14-15	47.67	0.03127
9	S13\RB	14-15	47.67	0.02849
10	S18\RB	14-15	47.67	0.00971
11	S19\RB	14-15	47.67	0.00691
12	S24\RB	14-15	47.67	ND
13	S25\RB	14-15	47.67	ND

RB: Round bread. Mean estimated quantity of 3-MCPD exposure for children = 0.013846  $\mu\text{g}/\text{kg}$

Lower concentration of 3-MCPD exposure for adults from round bread were 0.004577  $\mu\text{g}/\text{kg}$  body weight per day, higher concentration were 0.031277  $\mu\text{g}/\text{kg}$  body weight per day, and mean concentration of 3-MCPD exposure for adults were 0.013846  $\mu\text{g}/\text{kg}$ .

**Table 7.** Estimation concentration of 3-MCPD ( $\mu\text{g}/\text{kg}$ ) exposure for children age (14-15) years

ID	Name	Mean Kids Age	Body Weight	3-MCPD $\mu\text{g}/\text{kg}$ exposure
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1	S1\ TB	14-15	47.67	0.01192
2	S2/LB	14-15	47.67	0.00793
3	S3/ LB	14-15	47.67	0.00468
4	S4/LB	14-15	47.67	0.00562
14	S14/LB	14-15	47.67	0.01411
15	S15/ LB	14-15	47.67	0.01261
16	S16/LB	14-15	47.67	0.00460
17	S17/LB	14-15	47.67	0.00623
20	S20\TB	14-15	47.67	0.00354
21	S21\TB	14-15	47.67	ND
22	S22\TB	14-15	47.67	ND
23	S23\TB	14-15	47.67	0.00239

TB: Long bread Mean estimated quantity of 3-MCPD exposure for children = 0.00736 $\mu$ g/kg

from long bread. Lower concentration of 3-MCPD exposure for children from long bread were 0.002397 $\mu$ g/kg body weight per day, higher concentration were 0.014118 $\mu$ g/kg body weight per day, and mean concentration of 3-MCPD exposure for adults were 0.007368 $\mu$ g/kg. Concentration of 3-MCPD exposure for children from round bread higher than concentration of 3-MCPD exposure for children from long bread. Consequently, concentration of (3-MCPD) boy weight per day exposure for children from round and long bread were lower than concentration of (3-MCPD) body weight per day exposure for adults. Because, concentration of 3-MCPD body weight per day exposure increase by weight decrease and concentration of 3-MCPD ( $\mu$ g/kg) exposure decrease by weight increase.

Comparison with the international standard of 3-MCPD, results of international studies of 3-MCPD by The European commission's scientific committee for food established range tolerable daily (0.1 $\mu$ g/kg - 2 $\mu$ g/kg) body weight per day. Concentration of free 3-MCPD in round bread for adults WAS formed ranged to be between (0.15493-1.05873ppm), (i.e 0.005345-0.036538 $\mu$ g/kg), body weight per day, while concentration of 3-MCPD in long bread oil for adults range between (0.11334ppm – 0.667ppm), (i.e 0.002799-0.016488 $\mu$ g/kg ) body weight per day, while concentration of 3-MCPD in round bread for children range between (0.15493-1.05873ppm), (i.e 0.004577-0.031277 $\mu$ g/kg), body weight per day, and concentration of 3-MCPD in long bread oil for children ranged between(0.11334ppm – 0.667ppm), (i.e 0.002397-0.014118 $\mu$ g/kg ) body weight per day. The concentration of 3-MCPD were found in both round and long bread fat is lower than standard of European commission's scientific committee for food.

Comparison with studies of Karsulinova et al (2007), Dolezal et al., (2005), and Divinova et al., (2007) for the amount of 3-MCPD in bread range between (1.56-23.6mg/kg) of fat (i.e

5.7-84,9ug/kg) is higher than amount of 3-MCPD in round bread and long bread oil were found. WHO/JECFA (2007) was reported average dietary exposures of the general population from a wide range of foods, related products, ranged from 0.02 to 0.7 ug/kg (bw) per day, and these for consumers at the high percentage (95th), including young children ranged from 0.06 to 2.3 ug/kg bw per day.

While concentration of 3-MCPD in round bread for children range between (0.0045770-0.031277 $\mu$ g/kg), body weight per day, and the percentage of 3-MCPD in long bread oil for children range between (0.002397-0.014118 $\mu$ g/kg) body weight per day were found. While Hwang et al, (2009), reported value for mean intake level of 3-MCPD in the Republic of Korea was estimated in the range from 0.0009–0.0026ug/kg bw per day and at the 95th percentile of consumption was 0.005 ug/kg bw per day. And You et al (2008) reported the levels of 3-MCPD in a wide range of food items and estimated their dietary exposure for secondary school students in Hong Kong and they estimated the average exposure to be 0,063-0,150ug/kg bw per day. While that for high consumers was 0.152-0.300 ug/kg bw per day. While average MCPD exposure for children from long and round bread were (0.007368-0.013846  $\mu$ g/kg), respectively, and Mean estimated quantity of 3-MCPD exposure for Adults from long and round bread were (0.0086234-0.016171 $\mu$ g/kg), respectively.

## **CONCLUSION**

3-MCPD was detected in round and long bakery bread, and it was found with concentrations of 0.154931-0.5873ppm to 0.11334-0.59644ppm, respectively, which were lower than that of European Commission Scientific Committee for Food Standardization. Exposure of adults and children to 3-MCPD upon consumption of modern bakeries bread does not constitute a health hazard.

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## **Conflict of interest statement**

There is no conflict of interest pertaining to this study.

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