



**Specific migration study of Aluminium and other elements in
Aluminium Foil & Semi Rigid Container by using ICP-MS**

Study Conducted on Behalf of
Hindalco Innovation Centre-Semi Fab, Hindalco Industries Ltd.
Taloja, Raigad, Navi Mumbai

Report No:
NCL/Project/2025-26/10

Issue Date:
24/11/2025

Conducted by,
NDDB CALF LIMITED, Anand, Gujarat, India

NDDB CALF LIMITED

Issue Date: 24/11/2025

This is to certify that the study entitled **“Specific migration study of Aluminium and other heavy metal elements from Aluminium Foil & Semi Rigid Container to food items”** was carried out by NDDB CALF LTD. Anand, Gujarat, India.

The plan of work, findings and conclusion of this study are contained in the report no. NCL /Project/2025-26/10.

This study was focussed on Aluminium and other heavy metals.

Elements migrating in Aluminium Foil and Aluminium Semi Rigid Containers were studied through latest validated analytical techniques. The samples were prepared as per CALF/SOP/CHEM/MMS/07 and quantified by using ICP-MS. This experiment was planned as extension of earlier study conducted under NCL /Project/2023-24/04, NCL /Project/2024-25/01, NCL /Project/2024-25/12, NCL /Project/2025-26/03, NCL /Project/2025-26/05.

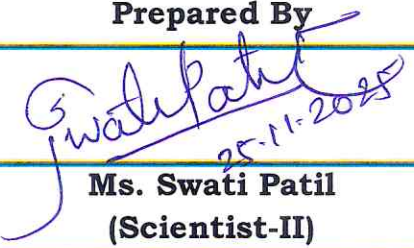
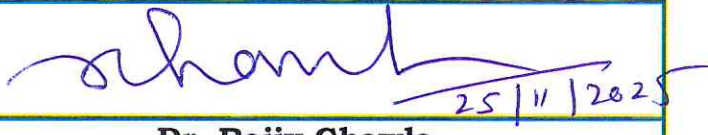
Prepared By	Approved By
 25-11-2025	 25/11/2025
Ms. Swati Patil (Scientist-II)	Dr. Rajiv Chawla (General Manager)

Table of Contents

1. BACKGROUND OF THE STUDY	3
2. MATERIALS AND METHODS.....	3
3. EXPERIMENT PLAN : Plan for Migration Study on Aluminium Foil (Super wrap/	3
Fresh wrap)	3
4. DATA FROM ICPMS: Elements concentration in mg/Kg	5
5. RESULTS.....	20
Results are given below:	20
5.1 Results of Specific migration in Aluminium Foil at different pH by using simulants....	20
5.2 Results of Specific migration in Aluminium Foil & Container	21
6. CONCLUSIONS:	33
7. REFERENCES	33

1. BACKGROUND OF THE STUDY

The study investigated the influence of freshly cooked food samples were wrapped or stored in aluminium foil and aluminium semi rigid containers, then kept at room temperature for 2, 4, 8, and 10 hours. At each storage interval, samples were collected and analysed to quantify aluminium and other heavy metal content – using Inductively Coupled Plasma Mass Spectrometry (ICP-MS). In addition, aluminium foils were subjected to migration studies using food simulants to evaluate the specific migration of aluminium and other heavy metals under controlled conditions.

2. MATERIALS & METHODS

The Experiment was conducted in two steps –

1. Specific Migration by using the different Simulants and analyse on ICP-MS
2. Packing the food items in foils and containers and store at 2, 4, 8, 10 hours and further analyse for specific migration of aluminium from foil and semi rigid container sample

De-ionized and double distilled water was used in all the experiments. Elements tested for specific migration are Aluminium (Al), Manganese (Mn), Iron (Fe), Cobalt (Co), Copper (Cu), Zinc (Zn), Arsenic (As), Cadmium (Cd), Barium (Ba), Mercury (Hg), Lead (Pb), Lithium (Li).

3. EXPERIMENT PLAN : Plan for Migration Study on Aluminium Foil (Super wrap/ Fresh wrap)

A. Migration of Aluminium and other elements from Foil Samples by using simulants at different time intervals at 40°C analysed by ICP-MS.

- i. Alcoholic Migration @ 40 deg. C under alcoholic condition for 2, 4, 6, 8 & 10 hours
- ii. Acidic Migration @ 40 deg. C under acidic condition at pH of 2.8 +/- 0.2 (2.6 – 3.0) Acid and high acid foods – e.g. Pickles for 2, 4, 6, 8 & 10 hours
- iii. Neutral: Migration @ 40 deg. C under Aqueous (Neutral) condition for 2, 4, 6, 8 & 10 hours -Double distilled glass water with a pH of 6.8 – 7.2 range could be used

B. Migration of Aluminium and other elements from Semi rigid container and foil samples stored at different time intervals and analysed by ICP-MS.

Foods items packed in Aluminium containers:

The selected food items were prepared and packed in respective container in duplicate for time interval of 0, 2, 4, 8, 10 hours.

- i. **Hot Foods :** Dal, Rice Kheer, Cooked Vegetables
- ii. **Normal Temperature :** Green Salad, Coconut Chutney, Cut Fruits
- iii. **Analysis done on 0 hour after 2, 4, 8 and 10th hour exposure. All tests to be done in duplicates.**

Foods items packed in aluminium Foil:

- i. Hot Foods : Roti - 2 rotis ; Puri - 3 puris ; Vegetables - 1 bowl of Boiled vegetables
- ii. Normal Temperature foods : Sandwich - 1 sandwich ; Pickle ; Fruits - e.g. Banana

Note

- i. All the food items listed above were bought *fresh* from a NDDB kitchen packed hot and carried to the lab for testing
- ii. Sandwich and Pickles were packed at nominal temperature.
- iii. These packed item in the foil and containers were kept for 2, 4, 8 & 10 hrs and while stored at ambient temperature.
- iv. All Food items were prepared in duplicates
- v. Test elements - Aluminium + heavy metals
- vi. Control sample also collected in a glass container.

4. DATA FROM ICPMS : Elements concentration in mg/Kg

Table :1 Data for specific migration of elements from Aluminium Foil : Condition -1 - Aqueous acidic pH 2.6 at 40°C

Sample code	Aluminium (Al) mg/kg	Manganese (Mn) mg/kg	Iron (Fe) mg/kg	Cobalt (Co) mg/kg	Copper (Cu) mg/kg	Zinc (Zn) mg/kg	Arsenic (As) mg/kg	Cadmium (Cd) mg/kg	Barium (Ba) mg/kg	Mercury (Hg) mg/kg	Lead (Pb) mg/kg	Lithium (Li) mg/kg
	LOQ=0.5 mg/kg	LOQ=0.3 mg/kg	LOQ=1.0 mg/kg	LOQ=0.02 5 mg/kg	LOQ=0.5 mg/kg	LOQ=0.5 mg/kg	LOQ=0.1 mg/kg	LOQ=0.1 mg/kg	LOQ=0.5 mg/kg	LOQ=0.1 mg/kg	LOQ=0.1 mg/kg	LOQ=0.3 mg/kg
Reagent Blank	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
2.6 pH 2hr-I	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
2.6 pH 2hr-II	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
2.6 pH 4hr-I	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
2.6 pH 4hr-II	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
2.6 pH 6hr-I	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
2.6 pH 6hr-II	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
2.6 pH 8hr-I	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
2.6 pH 8hr-II	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
2.6 pH 10hr-I	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
2.6 pH 10hr-II	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ

Data for specific migration of elements from Aluminium Foil : Condition -2 - Neutral 7.0 pH at 40°C

Sample code	Aluminium (Al) mg/kg	Manganese (Mn) mg/kg	Iron (Fe) mg/kg	Cobalt (Co) mg/kg	Copper (Cu) mg/kg	Zinc (Zn) mg/kg	Arsenic (As) mg/kg	Cadmium (Cd) mg/kg	Barium (Ba) mg/kg	Mercury (Hg) mg/kg	Lead (Pb) mg/kg	Lithium (Li) mg/kg
	LOQ=0.5 mg/kg	LOQ=0.3 mg/kg	LOQ=1.0 mg/kg	LOQ=0.02 5 mg/kg	LOQ=0.5 mg/kg	LOQ=0.5 mg/kg	LOQ=0.1 mg/kg	LOQ=0.1 mg/kg	LOQ=0.5 mg/kg	LOQ=0.1 mg/kg	LOQ=0.1 mg/kg	LOQ=0.3 mg/kg
Reagent Blank	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Neutral pH 2hr-I	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Neutral pH 2hr-II	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Neutral pH 4hr-I	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Neutral pH 4hr-II	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Neutral pH 6hr-I	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Neutral pH 6hr-II	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Neutral pH 8hr-I	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Neutral pH 8hr-II	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Neutral pH 10hr-I	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Neutral pH 10hr-II	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ

Data for specific migration of elements from Aluminium Foil : Condition -3 - 10% Alcoholic at 40°C

Sample code	Aluminium (Al) mg/kg	Manganese (Mn) mg/kg	Iron (Fe) mg/kg	Cobalt (Co) mg/kg	Copper (Cu) mg/kg	Zinc (Zn) mg/kg	Arsenic (As) mg/kg	Cadmium (Cd) mg/kg	Barium (Ba) mg/kg	Mercury (Hg) mg/kg	Lead (Pb) mg/kg	Lithium (Li) mg/kg
	LOQ=0.5 mg/kg	LOQ=0.3 mg/kg	LOQ=1.0 mg/kg	LOQ=0.02 5 mg/kg	LOQ=0.5 mg/kg	LOQ=0.5 mg/kg	LOQ=0.1 mg/kg	LOQ=0.1 mg/kg	LOQ=0.5 mg/kg	LOQ=0.1 mg/kg	LOQ=0.1 mg/kg	LOQ=0.3 mg/kg
Reagent Blank	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
10% Alcoholic pH 2hr-I	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
10% Alcoholic pH 2hr-II	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
10% Alcoholic pH 4hr-I	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
10% Alcoholic pH 4hr-II	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
10% Alcoholic pH 6hr-I	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
10% Alcoholic pH 6hr-II	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
10% Alcoholic pH 8hr-I	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
10% Alcoholic pH 8hr-II	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
10% Alcoholic pH 10hr-I	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
10% Alcoholic pH 10hr-II	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ

Table No:2 Data for specific migration of elements from Food items packed in Aluminium Container – Name of food item - Kheer

Sample code	Aluminium (Al) mg/kg	Manganese (Mn) mg/kg	Iron (Fe) mg/kg	Cobalt (Co) mg/kg	Copper (Cu) mg/kg	Zinc (Zn) mg/kg	Arsenic (As) mg/kg	Cadmium (Cd) mg/kg	Barium (Ba) mg/kg	Mercury (Hg) mg/kg	Lead (Pb) mg/kg	Lithium (Li) mg/kg
	LOQ=0.5 mg/kg	LOQ=0.3 mg/kg	LOQ=1.0 mg/kg	LOQ=0.02 5 mg/kg	LOQ=0.5 mg/kg	LOQ=0.5 mg/kg	LOQ=0.1 mg/kg	LOQ=0.1 mg/kg	LOQ=0.5 mg/kg	LOQ=0.1 mg/kg	LOQ=0.1 mg/kg	LOQ=0.3 mg/kg
Reagent Blank	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Kheer-I 0Hr	3.265	0.826	1.688	BLQ	BLQ	2.559	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Kheer-II 0Hr	3.227	0.908	1.561	BLQ	BLQ	2.912	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Kheer-I 2Hr	3.934	1.651	2.007	BLQ	BLQ	3.467	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Kheer-II 2Hr	3.374	1.286	1.924	BLQ	BLQ	3.442	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Kheer-I 4Hr	2.903	0.928	0.990	BLQ	BLQ	2.697	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Kheer-II 4Hr	5.011	1.048	1.550	BLQ	BLQ	3.133	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Kheer-I 8Hr	2.352	1.202	1.395	BLQ	BLQ	3.384	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Kheer-II 8Hr	2.204	1.194	1.522	BLQ	BLQ	3.484	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Kheer-I 10Hr	2.784	1.597	1.056	BLQ	BLQ	4.379	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Kheer-II 10Hr	2.806	1.348	1.331	BLQ	BLQ	3.789	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ

Table No:2 Data for specific migration of elements from Food items packed in Aluminium Container – Name of food item - Dal

Sample code	Aluminium (Al) mg/kg	Manganese (Mn) mg/kg	Iron (Fe) mg/kg	Cobalt (Co) mg/kg	Copper (Cu) mg/kg	Zinc (Zn) mg/kg	Arsenic (As) mg/kg	Cadmium (Cd) mg/kg	Barium (Ba) mg/kg	Mercury (Hg) mg/kg	Lead (Pb) mg/kg	Lithium (Li) mg/kg
	LOQ=0.5 mg/kg	LOQ=0.3 mg/kg	LOQ=1.0 mg/kg	LOQ=0.02 5 mg/kg	LOQ=0.5 mg/kg	LOQ=0.5 mg/kg	LOQ=0.1 mg/kg	LOQ=0.1 mg/kg	LOQ=0.5 mg/kg	LOQ=0.1 mg/kg	LOQ=0.1 mg/kg	LOQ=0.3 mg/kg
Reagent Blank	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Dal-I 0Hr	1.694	1.841	4.974	BLQ	1.407	3.496	BLQ	BLQ	0.591	BLQ	BLQ	BLQ
Dal-II 0Hr	2.859	2.056	5.595	BLQ	1.497	3.821	BLQ	BLQ	0.642	BLQ	BLQ	BLQ
Dal-I 2Hr	3.788	1.775	4.444	BLQ	1.261	3.508	BLQ	BLQ	0.686	BLQ	BLQ	BLQ
Dal-II 2Hr	1.786	1.774	3.964	BLQ	1.279	3.479	BLQ	BLQ	0.580	BLQ	BLQ	BLQ
Dal-I 4Hr	2.722	1.985	5.481	BLQ	1.495	4.014	BLQ	BLQ	0.632	BLQ	BLQ	BLQ
Dal-II 4Hr	2.458	2.498	6.038	BLQ	1.668	4.367	BLQ	BLQ	0.727	BLQ	BLQ	BLQ
Dal-I 8Hr	1.277	1.859	4.732	BLQ	1.288	3.474	BLQ	BLQ	0.501	BLQ	BLQ	BLQ
Dal-II 8Hr	1.892	2.187	4.968	BLQ	1.497	4.372	BLQ	BLQ	0.611	BLQ	BLQ	BLQ
Dal-I 10Hr	3.845	2.114	5.169	BLQ	1.467	3.851	BLQ	BLQ	0.716	BLQ	BLQ	BLQ
Dal-II 10Hr	1.568	2.125	5.297	BLQ	1.436	3.894	BLQ	BLQ	0.606	BLQ	BLQ	BLQ

Table No:2 Data for specific migration of elements from Food items packed in Aluminium Container – Name of food item – Cooked Vegetable

Sample code	Aluminium (Al) mg/kg	Manganese (Mn) mg/kg	Iron (Fe) mg/kg	Cobalt (Co) mg/kg	Copper (Cu) mg/kg	Zinc (Zn) mg/kg	Arsenic (As) mg/kg	Cadmium (Cd) mg/kg	Barium (Ba) mg/kg	Mercury (Hg) mg/kg	Lead (Pb) mg/kg	Lithium (Li) mg/kg
	LOQ=0.5 mg/kg	LOQ=0.3 mg/kg	LOQ=1.0 mg/kg	LOQ=0.02 5 mg/kg	LOQ=0.5 mg/kg	LOQ=0.5 mg/kg	LOQ=0.1 mg/kg	LOQ=0.1 mg/kg	LOQ=0.5 mg/kg	LOQ=0.1 mg/kg	LOQ=0.1 mg/kg	LOQ=0.3 mg/kg
Reagent Blank	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Cooked Veg-I 0Hr	4.913	3.742	9.587	BLQ	2.172	4.241	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Cooked Veg-II 0Hr	3.983	3.446	10.162	BLQ	0.721	3.507	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Cooked Veg-I 2Hr	6.079	3.272	10.070	BLQ	1.472	3.590	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Cooked Veg-II 2Hr	5.794	3.299	8.216	BLQ	2.789	3.647	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Cooked Veg-I 4Hr	7.007	3.388	8.200	BLQ	0.960	3.945	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Cooked Veg-II 4Hr	4.969	3.261	8.204	BLQ	0.892	3.573	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Cooked Veg-I 8Hr	4.029	3.094	8.019	BLQ	0.799	3.431	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Cooked Veg-II 8Hr	3.730	3.139	7.421	BLQ	0.544	3.189	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Cooked Veg-I 10Hr	7.037	2.943	7.356	BLQ	0.779	2.834	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Cooked Veg-II 10Hr	5.438	2.885	7.842	BLQ	0.729	2.846	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ

Table No:2 Data for specific migration of elements from Food items packed in Aluminium Container – Name of food item – Green Salad

Sample code	Aluminium (Al) mg/kg	Manganese (Mn) mg/kg	Iron (Fe) mg/kg	Cobalt (Co) mg/kg	Copper (Cu) mg/kg	Zinc (Zn) mg/kg	Arsenic (As) mg/kg	Cadmium (Cd) mg/kg	Barium (Ba) mg/kg	Mercury (Hg) mg/kg	Lead (Pb) mg/kg	Lithium (Li) mg/kg
	LOQ=0.5 mg/kg	LOQ=0.3 mg/kg	LOQ=1.0 mg/kg	LOQ=0.02 5 mg/kg	LOQ=0.5 mg/kg	LOQ=0.5 mg/kg	LOQ=0.1 mg/kg	LOQ=0.1 mg/kg	LOQ=0.5 mg/kg	LOQ=0.1 mg/kg	LOQ=0.1 mg/kg	LOQ=0.3 mg/kg
Reagent Blank	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Green Salad-I 0Hr	2.939	1.356	3.623	BLQ	1.300	2.860	BLQ	BLQ	1.110	BLQ	BLQ	BLQ
Green Salad-II 0Hr	1.505	1.266	3.535	BLQ	1.484	2.681	BLQ	BLQ	1.116	BLQ	BLQ	BLQ
Green Salad-I 2Hr	2.519	1.170	2.940	BLQ	1.711	2.589	BLQ	BLQ	0.412	BLQ	BLQ	BLQ
Green Salad-II 2Hr	1.421	1.224	3.448	BLQ	1.961	2.659	BLQ	BLQ	0.516	BLQ	BLQ	BLQ
Green Salad-I 4Hr	0.949	1.112	2.513	BLQ	1.254	2.620	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Green Salad-II 4Hr	1.458	1.220	2.542	BLQ	1.089	2.706	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Green Salad-I 8Hr	0.149	1.273	2.133	BLQ	1.155	2.603	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Green Salad-II 8Hr	0.222	1.277	2.532	BLQ	0.899	2.511	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Green Salad-I 10Hr	0.287	1.353	2.748	BLQ	1.250	2.646	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Green Salad-II 10Hr	0.349	1.368	2.638	BLQ	1.282	2.674	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ

Table No:2 Data for specific migration of elements from Food items packed in Aluminium Container – Name of food item – Coconut Chutney

Sample code	Aluminium (Al) mg/kg	Manganese (Mn) mg/kg	Iron (Fe) mg/kg	Cobalt (Co) mg/kg	Copper (Cu) mg/kg	Zinc (Zn) mg/kg	Arsenic (As) mg/kg	Cadmium (Cd) mg/kg	Barium (Ba) mg/kg	Mercury (Hg) mg/kg	Lead (Pb) mg/kg	Lithium (Li) mg/kg
	LOQ=0.5 mg/kg	LOQ=0.3 mg/kg	LOQ=1.0 mg/kg	LOQ=0.02 5 mg/kg	LOQ=0.5 mg/kg	LOQ=0.5 mg/kg	LOQ=0.1 mg/kg	LOQ=0.1 mg/kg	LOQ=0.5 mg/kg	LOQ=0.1 mg/kg	LOQ=0.1 mg/kg	LOQ=0.3 mg/kg
Reagent Blank	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Coconut Chutney-I 0Hr	1.869	4.817	13.227	BLQ	2.431	6.113	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Coconut Chutney-II 0Hr	2.029	4.813	13.806	BLQ	2.697	6.093	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Coconut Chutney-I 2Hr	2.754	4.293	11.802	BLQ	2.277	5.600	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Coconut Chutney-II 2Hr	2.333	4.718	13.435	BLQ	2.567	6.200	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Coconut Chutney-I 4Hr	3.030	4.488	12.338	BLQ	2.138	5.740	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Coconut Chutney-II 4Hr	1.934	4.563	13.060	BLQ	1.991	5.985	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Coconut Chutney-I 8Hr	2.196	4.561	13.247	BLQ	1.744	5.918	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Coconut Chutney-II 8Hr	1.539	4.764	14.073	BLQ	2.021	6.439	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Coconut Chutney-I 10Hr	1.652	4.383	11.955	BLQ	1.534	5.359	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Coconut Chutney-II 10Hr	1.915	4.718	12.795	BLQ	2.002	5.775	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ

Table No:2 Data for specific migration of elements from Food items packed in Aluminium Container – Name of food item - Fruits

Sample code	Aluminium (Al) mg/kg	Manganese (Mn) mg/kg	Iron (Fe) mg/kg	Cobalt (Co) mg/kg	Copper (Cu) mg/kg	Zinc (Zn) mg/kg	Arsenic (As) mg/kg	Cadmium (Cd) mg/kg	Barium (Ba) mg/kg	Mercury (Hg) mg/kg	Lead (Pb) mg/kg	Lithium (Li) mg/kg
	LOQ=0.5 mg/kg	LOQ=0.3 mg/kg	LOQ=1.0 mg/kg	LOQ=0.02 5 mg/kg	LOQ=0.5 mg/kg	LOQ=0.5 mg/kg	LOQ=0.1 mg/kg	LOQ=0.1 mg/kg	LOQ=0.5 mg/kg	LOQ=0.1 mg/kg	LOQ=0.1 mg/kg	LOQ=0.3 mg/kg
Reagent Blank	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Fruits-I 0Hr	2.123	0.337	2.250	BLQ	0.872	0.876	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Fruits-II 0Hr	1.275	0.346	1.906	BLQ	0.698	0.630	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Fruits-I 2Hr	1.273	0.276	1.640	BLQ	1.556	0.688	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Fruits-II 2Hr	0.709	0.261	1.564	BLQ	1.580	0.633	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Fruits-I 4Hr	1.201	0.328	1.535	BLQ	0.496	0.576	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Fruits-II 4Hr	2.261	0.322	1.679	BLQ	0.507	0.592	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Fruits-I 8Hr	0.004	0.292	1.658	BLQ	0.618	0.623	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Fruits-II 8Hr	0.000	0.254	1.430	BLQ	0.432	0.481	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Fruits-I 10Hr	1.379	0.269	2.421	BLQ	0.599	0.655	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Fruits-II 10Hr	2.123	0.337	2.250	BLQ	0.872	0.876	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ

Table No: 3 Data for specific migration of elements of elements from Food items packed in Aluminium Foil– Name of food item - Roti

Sample code	Aluminium (Al) mg/kg	Manganese (Mn) mg/kg	Iron (Fe) mg/kg	Cobalt (Co) mg/kg	Copper (Cu) mg/kg	Zinc (Zn) mg/kg	Arsenic (As) mg/kg	Cadmium (Cd) mg/kg	Barium (Ba) mg/kg	Mercury (Hg) mg/kg	Lead (Pb) mg/kg	Lithium (Li) mg/kg
	LOQ=0.5 mg/kg	LOQ=0.3 mg/kg	LOQ=1.0 mg/kg	LOQ=0.02 5 mg/kg	LOQ=0.5 mg/kg	LOQ=0.5 mg/kg	LOQ=0.1 mg/kg	LOQ=0.1 mg/kg	LOQ=0.5 mg/kg	LOQ=0.1 mg/kg	LOQ=0.1 mg/kg	LOQ=0.3 mg/kg
Reagent Blank	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Roti-I 0Hr	15.520	15.579	33.577	BLQ	2.655	18.721	BLQ	BLQ	2.041	BLQ	BLQ	BLQ
Roti-II 0Hr	13.510	15.256	34.466	BLQ	2.534	18.007	BLQ	BLQ	2.004	BLQ	BLQ	BLQ
Roti-I 2Hr	13.951	15.055	33.878	BLQ	2.620	17.805	BLQ	BLQ	1.963	BLQ	BLQ	BLQ
Roti-II 2Hr	12.811	15.518	33.057	BLQ	2.615	17.872	BLQ	BLQ	1.996	BLQ	BLQ	BLQ
Roti-I 4Hr	13.260	15.160	33.869	BLQ	2.587	17.415	BLQ	BLQ	1.911	BLQ	BLQ	BLQ
Roti-II 4Hr	13.126	15.336	33.401	BLQ	3.170	18.141	BLQ	BLQ	1.930	BLQ	BLQ	BLQ
Roti-I 8Hr	14.048	15.758	35.520	BLQ	2.507	17.392	BLQ	BLQ	1.878	BLQ	BLQ	BLQ
Roti-II 8Hr	12.549	15.739	33.511	BLQ	2.511	17.474	BLQ	BLQ	1.884	BLQ	BLQ	BLQ
Roti-I 10Hr	13.574	15.784	35.461	BLQ	2.299	17.353	BLQ	BLQ	1.824	BLQ	BLQ	BLQ
Roti-II 10Hr	14.189	15.726	33.674	BLQ	2.364	17.433	BLQ	BLQ	1.805	BLQ	BLQ	BLQ

Table No: 3 Data for specific migration of elements of elements from Food items packed in Aluminium Foil- Name of food item - Puri

Sample code	Aluminium (Al) mg/kg	Manganese (Mn) mg/kg	Iron (Fe) mg/kg	Cobalt (Co) mg/kg	Copper (Cu) mg/kg	Zinc (Zn) mg/kg	Arsenic (As) mg/kg	Cadmium (Cd) mg/kg	Barium (Ba) mg/kg	Mercury (Hg) mg/kg	Lead (Pb) mg/kg	Lithium (Li) mg/kg
	LOQ=0.5 mg/kg	LOQ=0.3 mg/kg	LOQ=1.0 mg/kg	LOQ=0.025 mg/kg	LOQ=0.5 mg/kg	LOQ=0.5 mg/kg	LOQ=0.1 mg/kg	LOQ=0.1 mg/kg	LOQ=0.5 mg/kg	LOQ=0.1 mg/kg	LOQ=0.1 mg/kg	LOQ=0.3 mg/kg
Reagent Blank	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Puri-I 0Hr	12.480	14.250	30.410	BLQ	5.933	18.619	BLQ	BLQ	1.885	BLQ	BLQ	BLQ
Puri-II 0Hr	11.267	13.797	29.204	BLQ	3.389	16.949	BLQ	BLQ	1.727	BLQ	BLQ	BLQ
Puri-I 2Hr	12.629	13.455	28.378	BLQ	2.011	15.169	BLQ	BLQ	1.699	BLQ	BLQ	BLQ
Puri-II 2Hr	14.420	13.268	29.063	BLQ	1.996	15.477	BLQ	BLQ	1.761	BLQ	BLQ	BLQ
Puri-I 4Hr	11.598	13.411	28.606	BLQ	2.291	15.351	BLQ	BLQ	1.711	BLQ	BLQ	BLQ
Puri-II 4Hr	12.082	12.651	27.040	BLQ	1.919	14.127	BLQ	BLQ	1.565	BLQ	BLQ	BLQ
Puri-I 8Hr	11.728	13.595	28.383	BLQ	1.946	15.094	BLQ	BLQ	1.596	BLQ	BLQ	BLQ
Puri-II 8Hr	11.003	12.910	26.547	BLQ	1.882	14.523	BLQ	BLQ	1.592	BLQ	BLQ	BLQ
Puri-I 10Hr	13.814	14.002	29.815	BLQ	2.089	15.436	BLQ	BLQ	1.573	BLQ	BLQ	BLQ
Puri-II 10Hr	13.222	13.833	29.370	BLQ	2.047	14.845	BLQ	BLQ	1.565	BLQ	BLQ	BLQ

Table No: 3 Data for specific migration of elements of elements from Food items packed in Aluminium Foil- Name of food item – Boiled Vegetable

Sample code	Aluminium (Al) mg/kg	Manganese (Mn) mg/kg	Iron (Fe) mg/kg	Cobalt (Co) mg/kg	Copper (Cu) mg/kg	Zinc (Zn) mg/kg	Arsenic (As) mg/kg	Cadmium (Cd) mg/kg	Barium (Ba) mg/kg	Mercury (Hg) mg/kg	Lead (Pb) mg/kg	Lithium (Li) mg/kg
	LOQ=0.5 mg/kg	LOQ=0.3 mg/kg	LOQ=1.0 mg/kg	LOQ=0.02 5 mg/kg	LOQ=0.5 mg/kg	LOQ=0.5 mg/kg	LOQ=0.1 mg/kg	LOQ=0.1 mg/kg	LOQ=0.5 mg/kg	LOQ=0.1 mg/kg	LOQ=0.1 mg/kg	LOQ=0.3 mg/kg
Reagent Blank	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Boiled Veg-I 0Hr	1.365	2.141	6.266	BLQ	1.497	3.179	BLQ	BLQ	0.846	BLQ	BLQ	BLQ
Boiled Veg-II 0Hr	2.154	2.153	6.138	BLQ	1.487	3.340	BLQ	BLQ	0.810	BLQ	BLQ	BLQ
Boiled Veg-I 2Hr	1.724	1.398	4.243	BLQ	1.117	2.549	BLQ	BLQ	0.588	BLQ	BLQ	BLQ
Boiled Veg-II 2Hr	4.517	1.815	5.596	BLQ	1.294	3.161	BLQ	BLQ	0.654	BLQ	BLQ	BLQ
Boiled Veg-I 4Hr	1.517	1.988	5.805	BLQ	0.630	3.058	BLQ	BLQ	0.674	BLQ	BLQ	BLQ
Boiled Veg-II 4Hr	3.056	2.031	6.368	BLQ	0.604	3.077	BLQ	BLQ	0.659	BLQ	BLQ	BLQ
Boiled Veg-I 8Hr	0.989	1.931	5.578	BLQ	0.624	3.063	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Boiled Veg-II 8Hr	1.325	2.354	7.131	BLQ	0.894	3.688	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Boiled Veg-I10Hr	1.197	2.124	5.769	BLQ	0.738	2.763	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Boiled Veg-II10Hr	1.894	1.643	4.645	BLQ	0.545	2.212	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ

Table No: 3 Data for specific migration of elements of elements from Food items packed in Aluminium Foil- Name of food item - Sandwich

Sample code	Aluminium (Al) mg/kg	Manganese (Mn) mg/kg	Iron (Fe) mg/kg	Cobalt (Co) mg/kg	Copper (Cu) mg/kg	Zinc (Zn) mg/kg	Arsenic (As) mg/kg	Cadmium (Cd) mg/kg	Barium (Ba) mg/kg	Mercury (Hg) mg/kg	Lead (Pb) mg/kg	Lithium (Li) mg/kg
	LOQ=0.5 mg/kg	LOQ=0.3 mg/kg	LOQ=1.0 mg/kg	LOQ=0.02 5 mg/kg	LOQ=0.5 mg/kg	LOQ=0.5 mg/kg	LOQ=0.1 mg/kg	LOQ=0.1 mg/kg	LOQ=0.5 mg/kg	LOQ=0.1 mg/kg	LOQ=0.1 mg/kg	LOQ=0.3 mg/kg
Reagent Blank	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Sandwich-I 0Hr	2.939	2.721	8.318	BLQ	1.573	6.233	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Sandwich-II 0Hr	3.573	2.806	8.175	BLQ	1.106	6.616	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Sandwich-I 2Hr	4.256	3.477	8.693	BLQ	0.865	6.680	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Sandwich-II 2Hr	4.467	3.606	9.277	BLQ	0.879	7.023	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Sandwich-I 4Hr	5.381	2.449	7.259	BLQ	0.836	5.568	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Sandwich-II 4Hr	5.586	2.604	7.060	BLQ	0.847	5.945	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Sandwich-I 8Hr	3.077	2.854	8.374	BLQ	1.101	6.325	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Sandwich-II 8Hr	3.289	3.116	7.551	BLQ	0.946	6.178	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Sandwich-I 10Hr	2.636	2.986	9.377	BLQ	0.745	5.878	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Sandwich-II 10Hr	2.337	2.504	6.366	BLQ	0.639	5.349	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ

Table No: 3 Data for specific migration of elements of elements from Food items packed in Aluminium Foil– Name of food item – Banana

Sample code	Aluminium (Al) mg/kg	Manganese (Mn) mg/kg	Iron (Fe) mg/kg	Cobalt (Co) mg/kg	Copper (Cu) mg/kg	Zinc (Zn) mg/kg	Arsenic (As) mg/kg	Cadmium (Cd) mg/kg	Barium (Ba) mg/kg	Mercury (Hg) mg/kg	Lead (Pb) mg/kg	Lithium (Li) mg/kg
	LOQ=0.5 mg/kg	LOQ=0.3 mg/kg	LOQ=1.0 mg/kg	LOQ=0.02 5 mg/kg	LOQ=0.5 mg/kg	LOQ=0.5 mg/kg	LOQ=0.1 mg/kg	LOQ=0.1 mg/kg	LOQ=0.5 mg/kg	LOQ=0.1 mg/kg	LOQ=0.1 mg/kg	LOQ=0.3 mg/kg
Reagent Blank	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Banana-I 0Hr	1.035	0.990	2.266	BLQ	BLQ	1.693	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Banana-II 0Hr	0.660	1.004	2.427	BLQ	BLQ	1.618	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Banana-I 2Hr	0.923	1.020	2.216	BLQ	BLQ	1.416	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Banana-II 2Hr	1.792	0.881	2.071	BLQ	BLQ	1.341	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Banana-I 4Hr	0.969	1.007	2.021	BLQ	BLQ	1.496	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Banana-II 4Hr	0.759	1.045	2.151	BLQ	BLQ	1.520	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Banana-I 8Hr	0.190	1.000	2.083	BLQ	BLQ	1.214	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Banana-II 8Hr	0.000	1.095	2.127	BLQ	BLQ	1.332	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Banana-I 10Hr	0.101	1.040	1.969	BLQ	BLQ	1.492	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Banana-II 10Hr	0.258	0.941	4.693	BLQ	BLQ	1.375	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ

Table No: 3 Data for specific migration of elements of elements from Food items packed in Aluminium Foil- Name of food item - Pickle

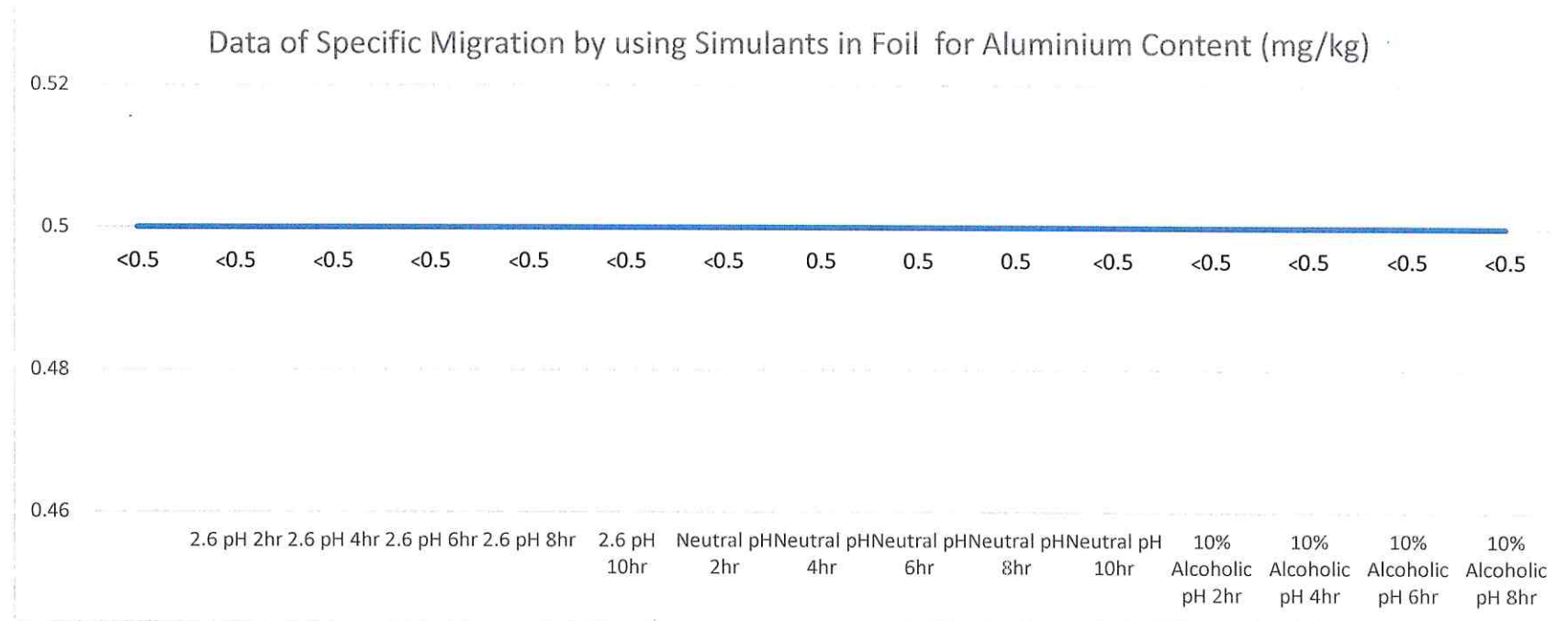
Sample code	Aluminium (Al) mg/kg	Manganese (Mn) mg/kg	Iron (Fe) mg/kg	Cobalt (Co) mg/kg	Copper (Cu) mg/kg	Zinc (Zn) mg/kg	Arsenic (As) mg/kg	Cadmium (Cd) mg/kg	Barium (Ba) mg/kg	Mercury (Hg) mg/kg	Lead (Pb) mg/kg	Lithium (Li) mg/kg
	LOQ=0.5 mg/kg	LOQ=0.3 mg/kg	LOQ=1.0 mg/kg	LOQ=0.02 5 mg/kg	LOQ=0.5 mg/kg	LOQ=0.5 mg/kg	LOQ=0.1 mg/kg	LOQ=0.1 mg/kg	LOQ=0.5 mg/kg	LOQ=0.1 mg/kg	LOQ=0.1 mg/kg	LOQ=0.3 mg/kg
Reagent Blank	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Pickle-I 0Hr	9.195	2.037	17.830	BLQ	BLQ	1.841	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Pickle-II 0Hr	13.228	2.064	18.674	BLQ	BLQ	1.889	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Pickle-I 2Hr	13.669	1.913	18.984	BLQ	BLQ	1.779	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Pickle-II 2Hr	14.112	1.945	19.830	BLQ	BLQ	1.833	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Pickle-I 4Hr	14.341	1.983	20.825	BLQ	BLQ	1.721	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Pickle-II 4Hr	16.498	1.901	19.914	BLQ	BLQ	1.663	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Pickle-I 8Hr	10.087	1.995	19.103	BLQ	BLQ	2.702	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Pickle-II 8Hr	13.597	1.947	19.946	BLQ	BLQ	1.774	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Pickle-I 10Hr	13.169	1.894	19.737	BLQ	BLQ	1.647	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ
Pickle-II 10Hr	8.883	1.951	16.754	BLQ	BLQ	1.904	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ

5. RESULTS

Results are given below:

5.1 Results of Specific migration in Aluminium Foil at different pH by using simulants

Aqueous pH 2.4, Neutral pH and 10% Alcoholic Aluminium (Al), Manganese (Mn), Iron (Fe), Copper (Cu), Zinc (Zn), Cobalt (Co), Arsenic (As), Cadmium (Cd), Barium (Ba), Mercury (Hg), Lead (Pb), Lithium (Li) are below limit of quantification at LOQ 0.5 mg/kg.

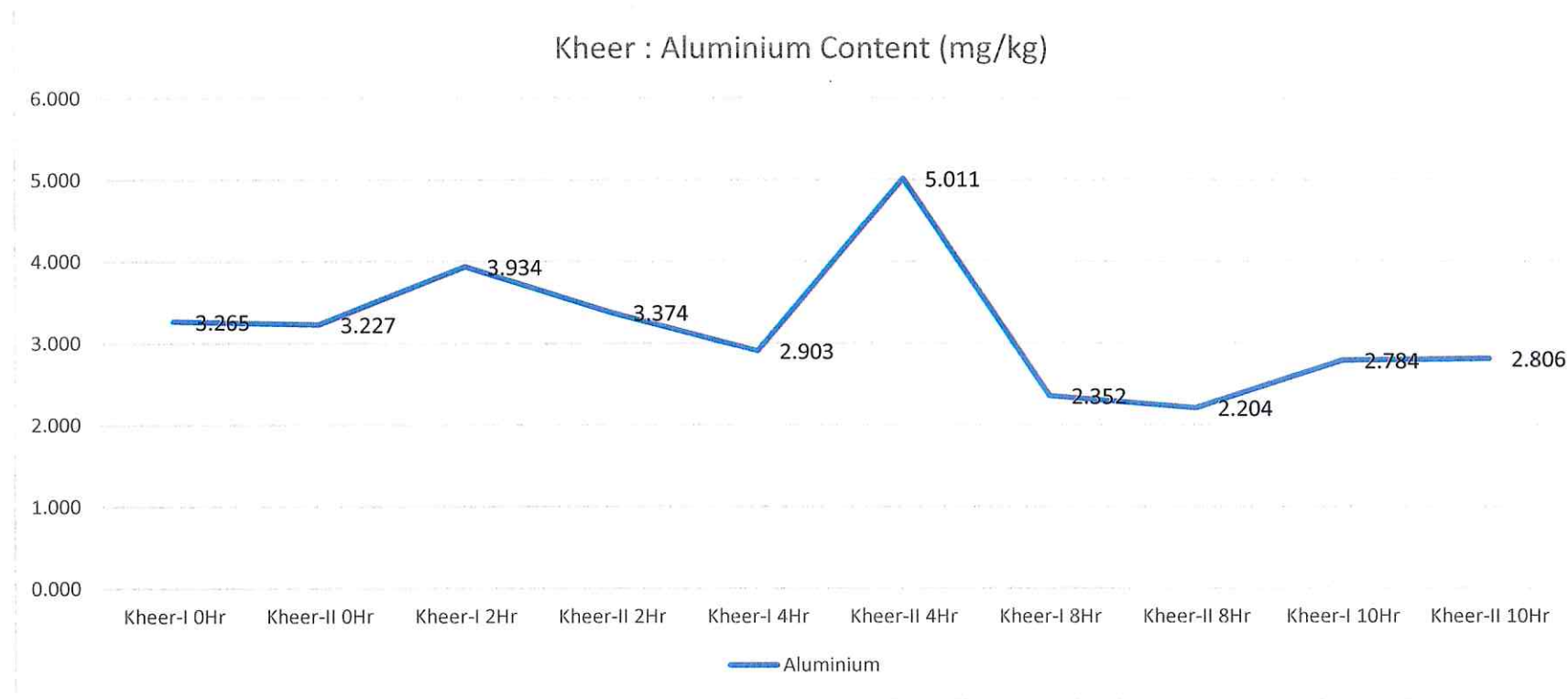


5.2 Results of Specific migration in Aluminium Foil & Container

Food packed in Container:

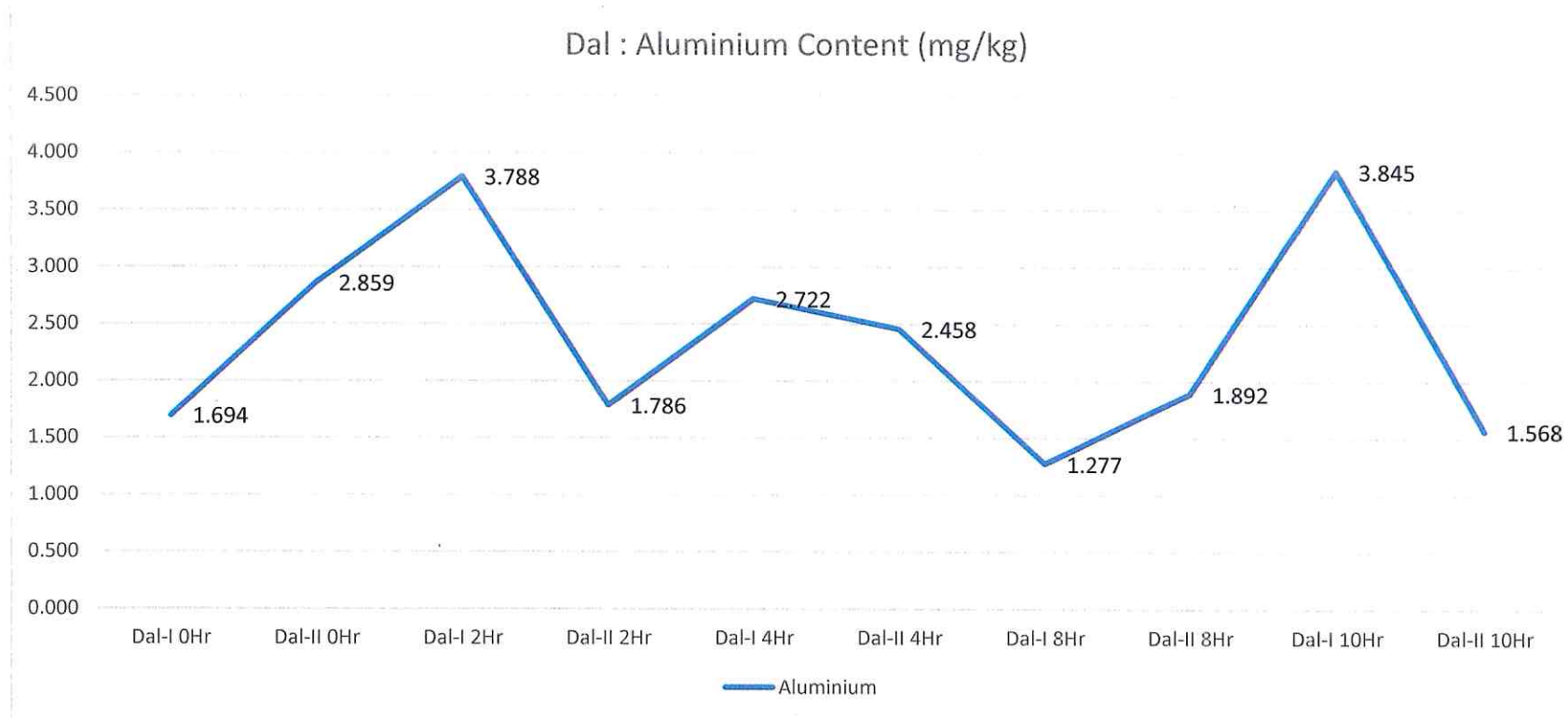
1. Rice Kheer:

The average aluminium content in 0 hours sample is 3.246 mg/kg. However, in other interval the aluminium content is between 2.204 to 5.011 mg/kg, Manganese is between 0.826 to 1.597 mg/kg, Iron is between 0.990 to 2.007 mg/kg and Zinc is between 2.559 to 4.379 mg/kg. Whereas other elements were below the limit of quantification



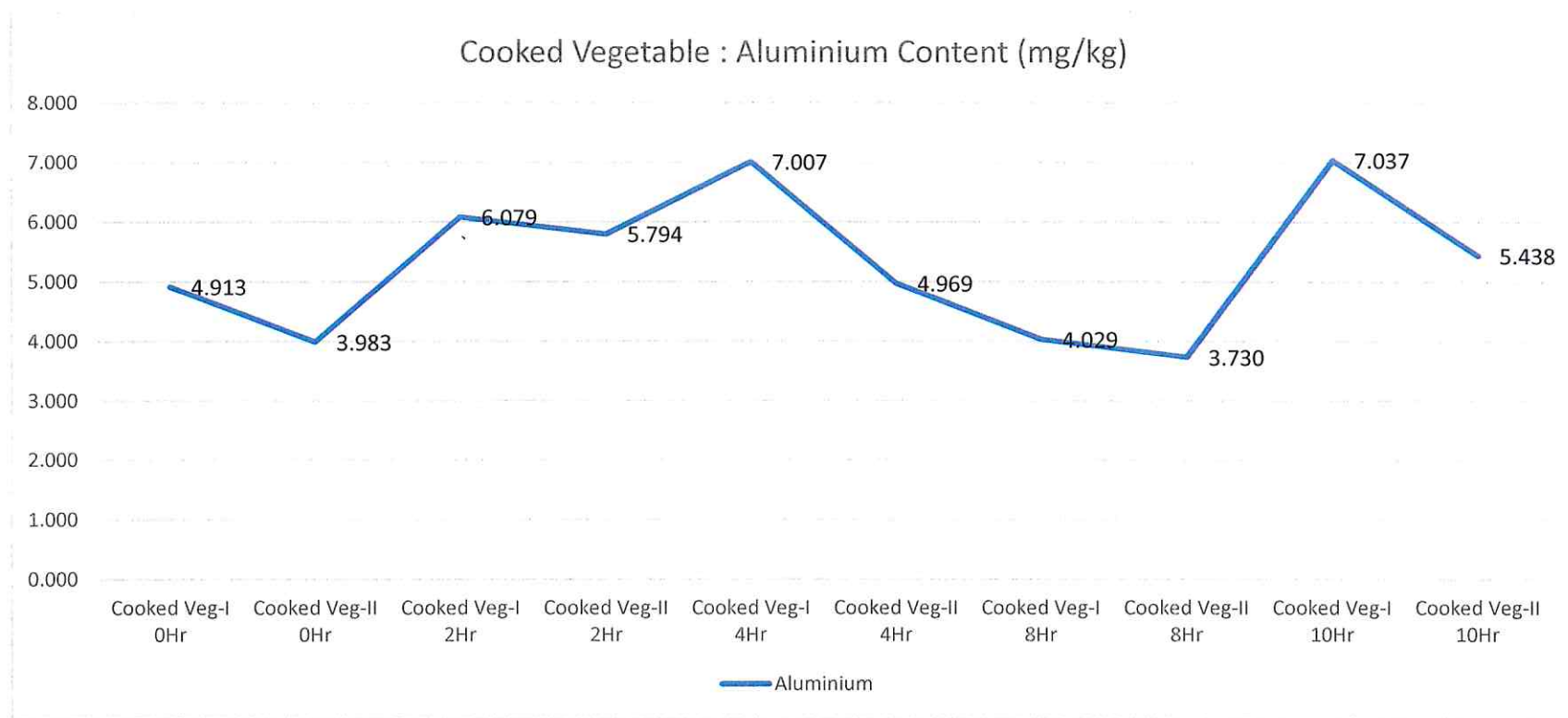
2. Dal:

The average aluminium content in 0 hours sample is 2.276 mg/kg. However, in other interval the aluminium content is between 1.277 to 3.845 mg/kg, Manganese is between 1.774 to 2.498 mg/kg, Iron is between 3.964 to 6.038 mg/kg and Zinc is between 3.474 to 4.372 mg/kg. Whereas other elements were below the limit of quantification



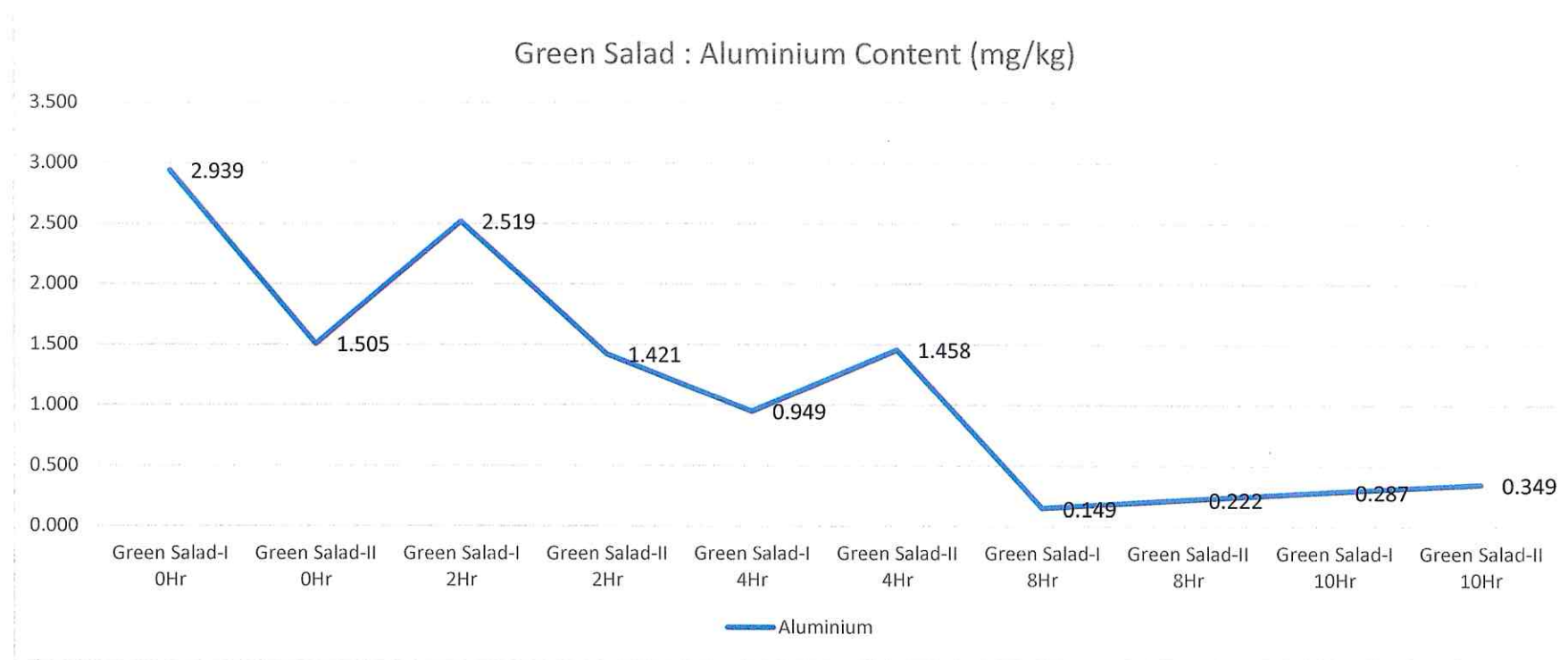
3. Cooked Vegetable:

The average aluminium content in 0 hours sample is 4.448 mg/kg. However, in other interval the aluminium content is between 3.730 to 7.037 mg/kg, Manganese is between 2.885 to 3.742 mg/kg, Iron is between 7.356 to 10.162 mg/kg and Zinc is between 2.834 to 4.241 mg/kg. Whereas other elements were below the limit of quantification



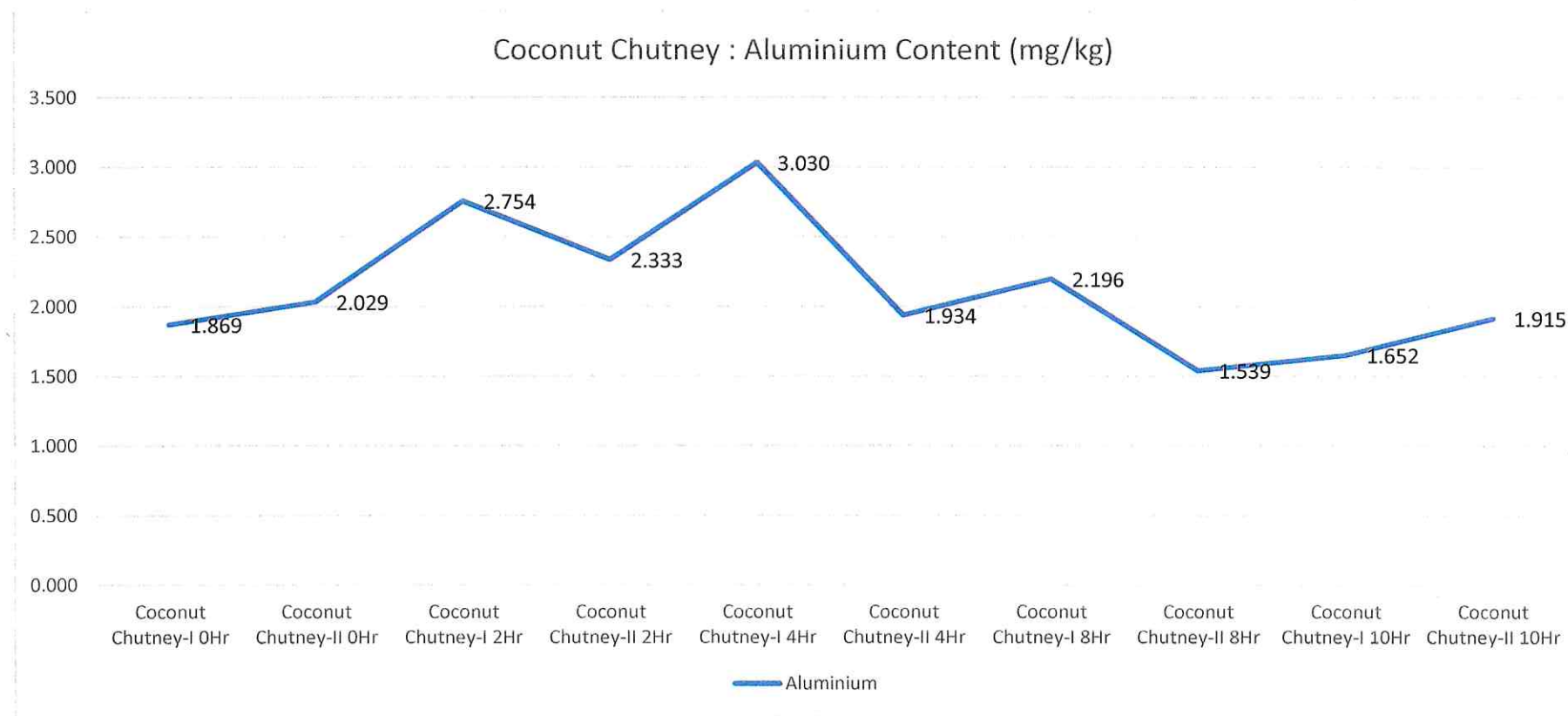
4. Green Salad:

The average aluminium content in 0 hours sample is 2.222 mg/kg. However, in other interval the aluminium content is between 0.149 to 2.519 mg/kg, Manganese is between 1.112 to 1.356 mg/kg, Iron is between 2.133 to 3.623 mg/kg and Zinc is between 2.511 to 2.706 mg/kg. Whereas other elements were below the limit of quantification



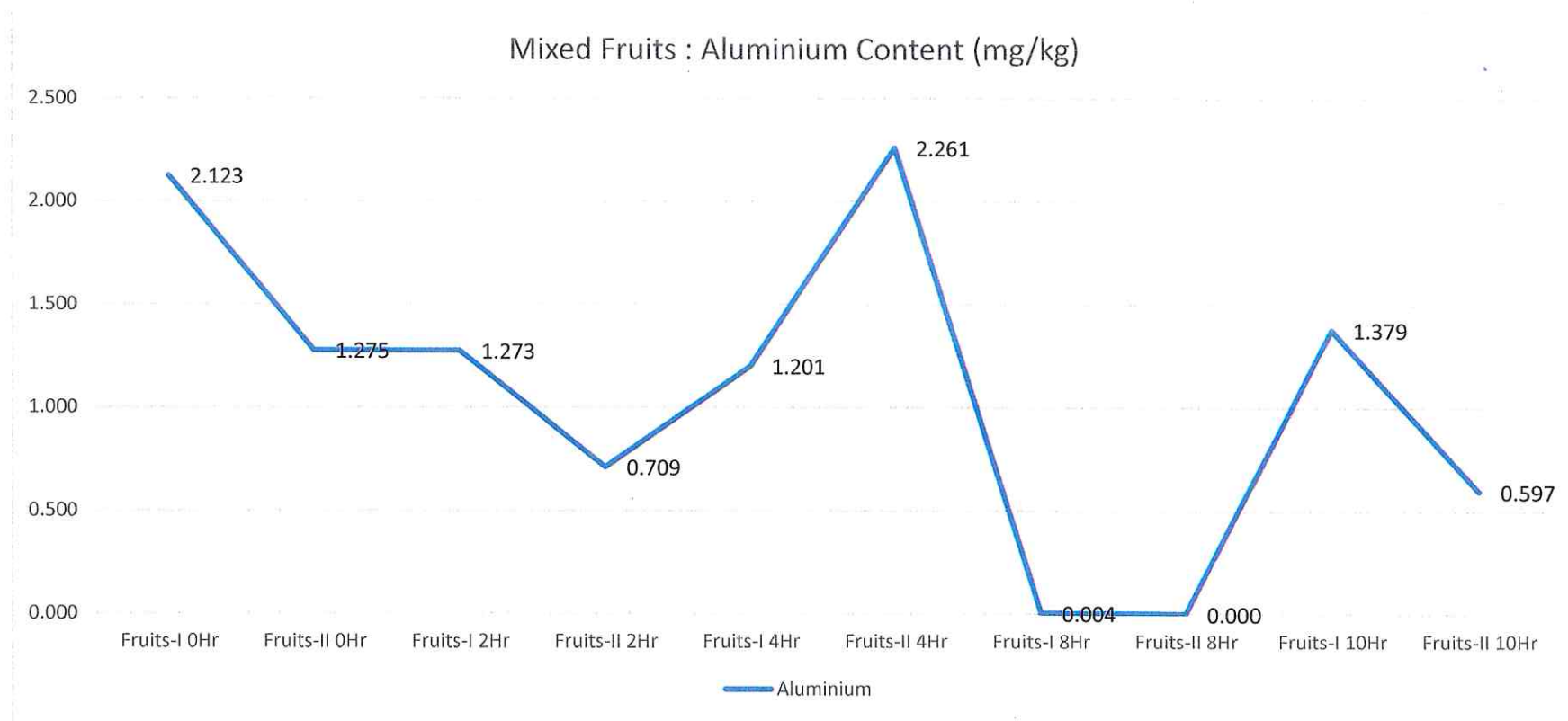
5. Coconut Chutney:

The average aluminium content in 0 hours sample is 1.949 mg/kg. However, in other interval the aluminium content is between 1.539 to 3.030 mg/kg, Manganese is approximately ≤ 4.817 mg/kg, Iron is between 11.802 to 14.073 mg/kg and Zinc is approximately ≤ 6.439 mg/kg. Whereas other elements were below the limit of quantification



6. Fruits:

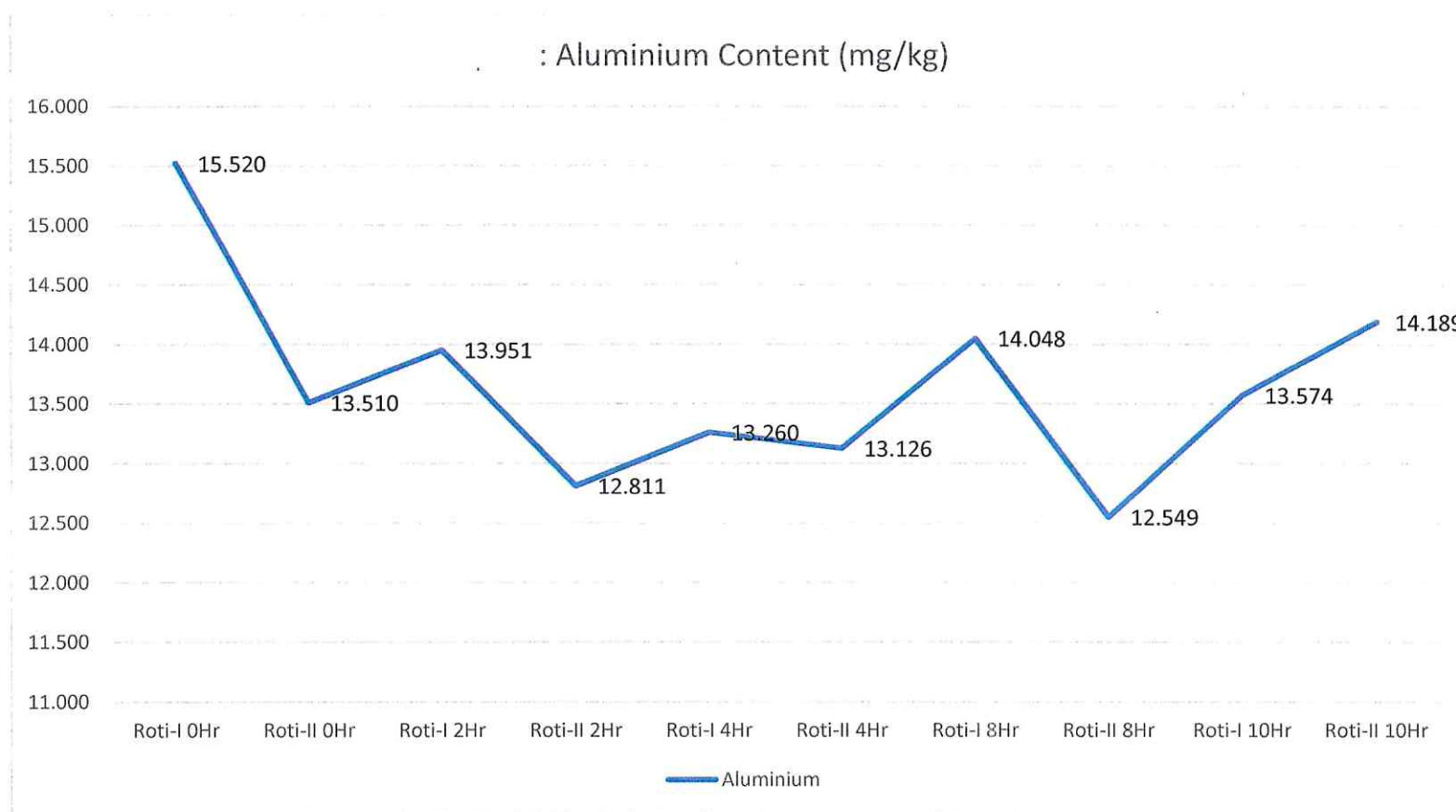
The average aluminium content in 0 hours sample is 1.699 mg/kg. However, in other interval the aluminium content is ≤ 2.261 mg/kg, Iron is ≤ 2.421 mg/kg and Zinc is approximately ≤ 0.876 mg/kg. Whereas other elements were below the limit of quantification



Food packed in Aluminium Foil:

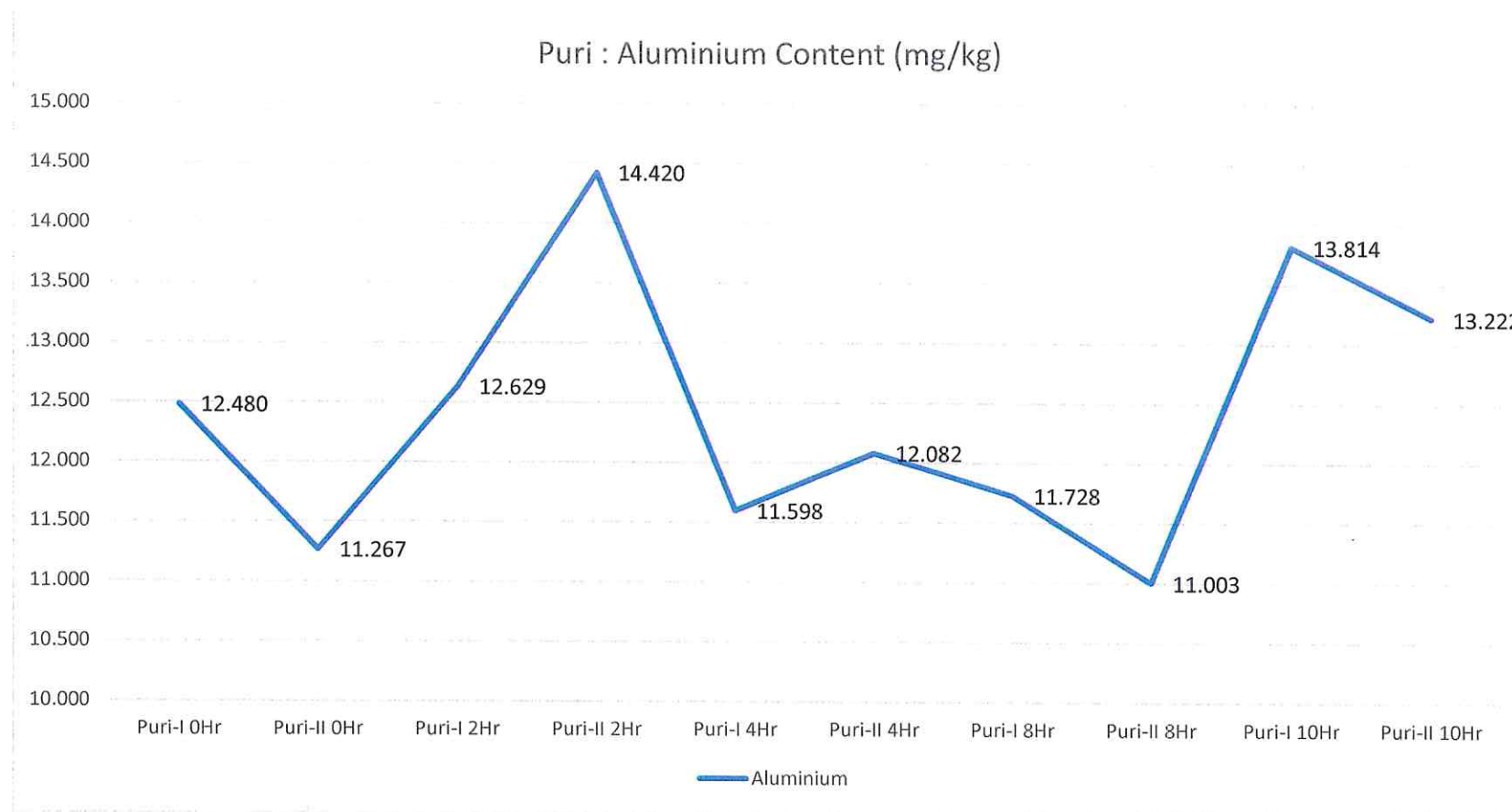
7. Roti:

The average aluminium content in 0 hours sample is 14.515 mg/kg. However, in other interval the aluminium content is between 12.549 to 14.189 mg/kg, Manganese is approximately ≤ 15.789 mg/kg, Iron is approximately ≤ 35.520 mg/kg and Zinc is approximately ≤ 18.721 mg/kg. Whereas other elements were below the limit of quantification



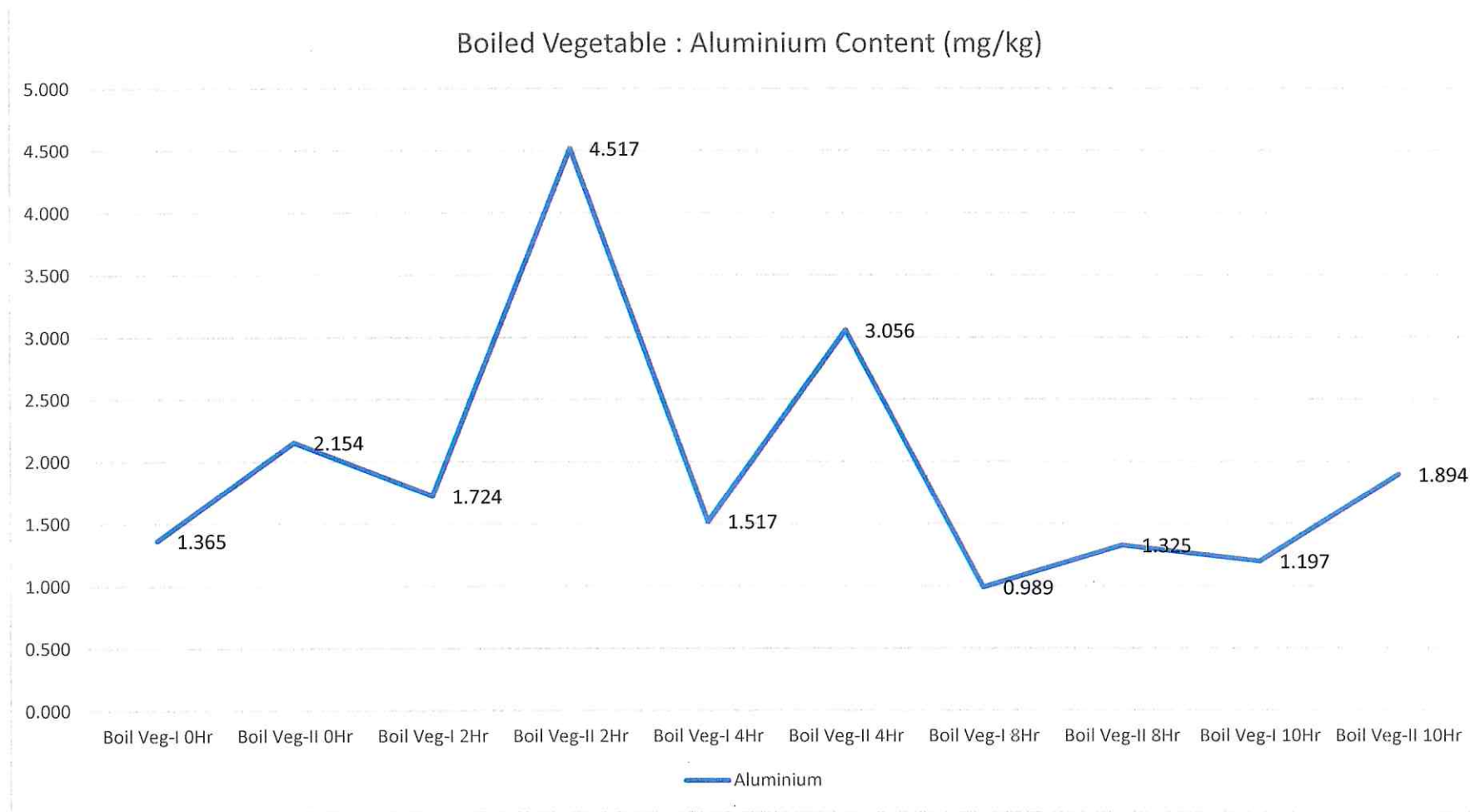
8. Puri:

The average aluminium content in 0 hours sample is 11.874 mg/kg. However, in other interval the aluminium content is between 11.003 to 14.420 mg/kg, Manganese is between 12.651 to 14.250 mg/kg, Iron is between 26.547 to 30.410 mg/kg and Zinc is approximately ≤ 18.619 mg/kg. Whereas other elements were below the limit of quantification



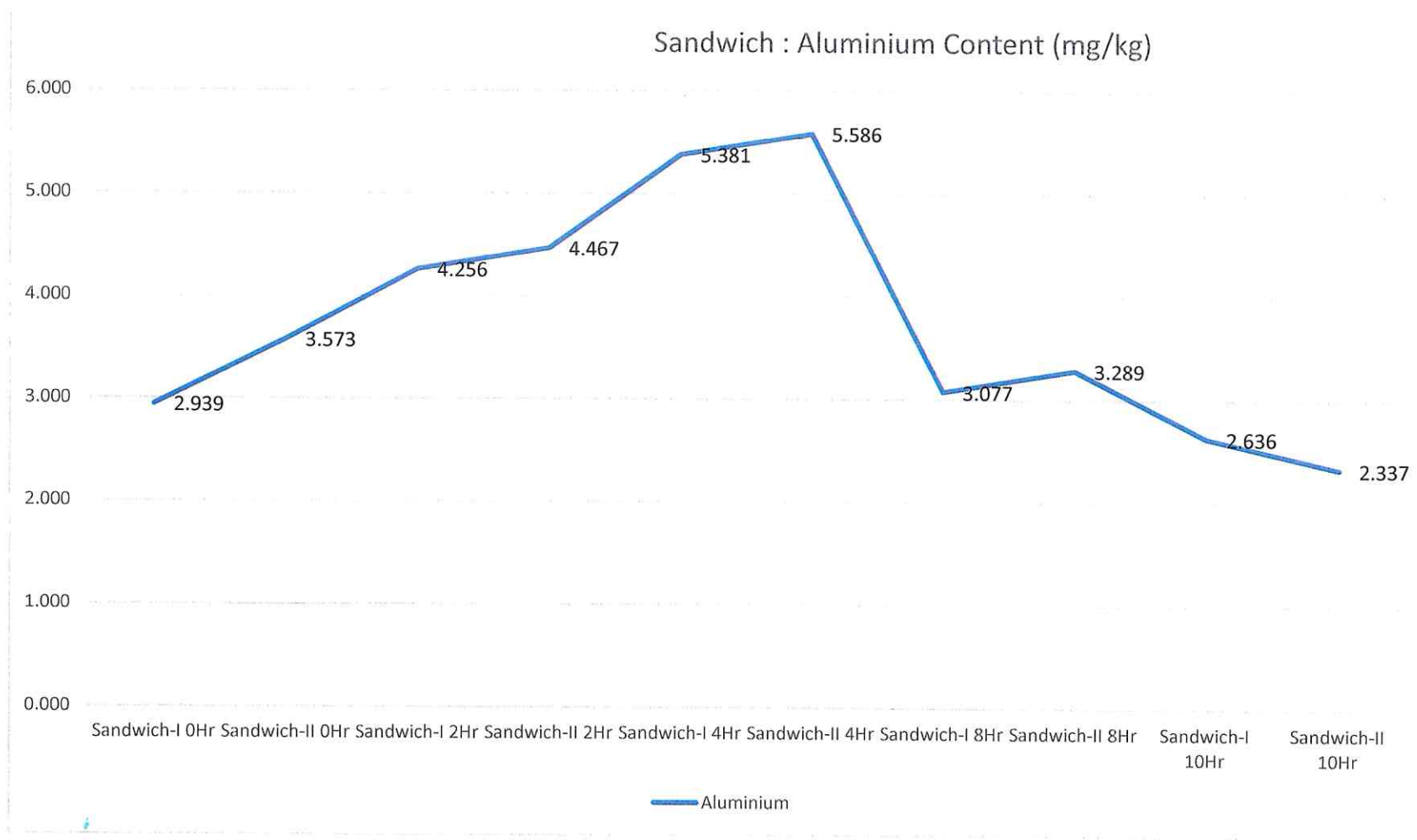
9. Boiled Vegetable:

The average aluminium content in 0 hours sample is 1.760 mg/kg. However, in other interval the aluminium content is between 0.989 to 4.517 mg/kg, Manganese is between 1.398 to 2.354 mg/kg, Iron is between 4.243 to 7.131 mg/kg and Zinc is approximately ≤ 3.688 mg/kg. Whereas other elements were below the limit of quantification



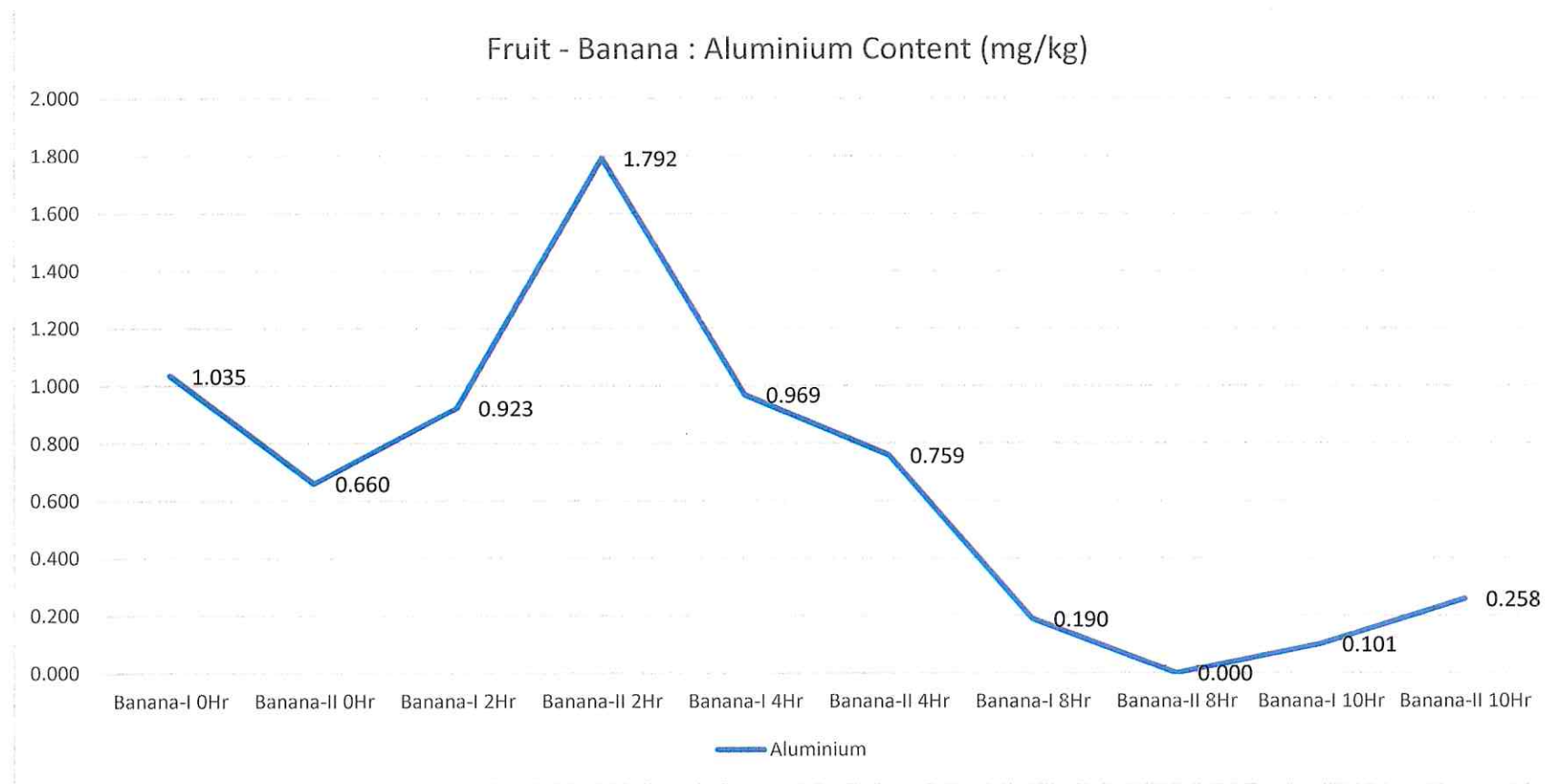
10. Sandwich:

The average aluminium content in 0 hours sample is 3.256 mg/kg. However, in other interval the aluminium content is between 2.337 to 5.586 mg/kg, Manganese is between 2.449 to 3.606 mg/kg, Iron is between 6.366 to 9.377 mg/kg and Zinc is approximately ≤ 7.023 mg/kg. Whereas other elements were below the limit of quantification



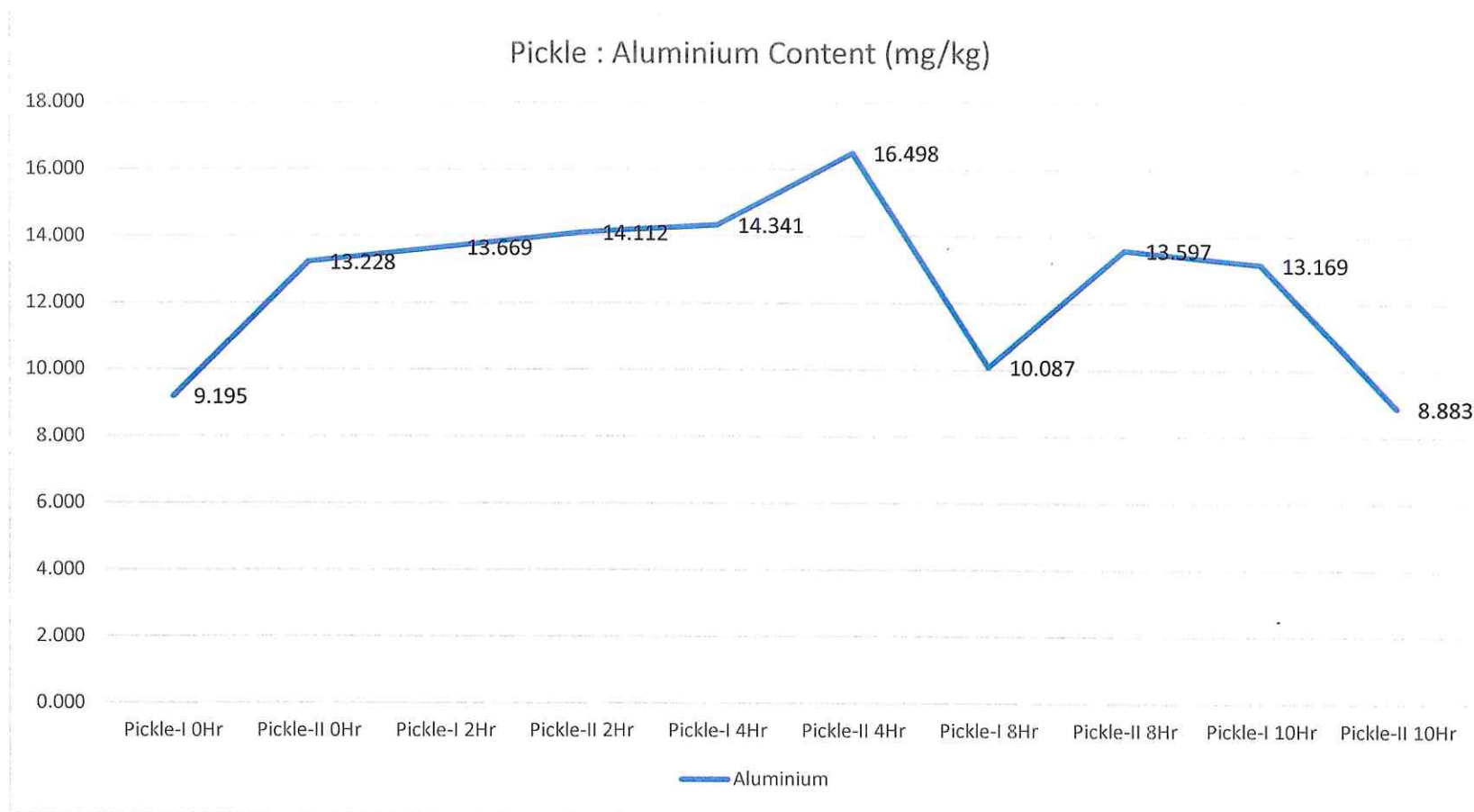
11. Banana:

The average aluminium content in 0 hours sample is 0.848 mg/kg. However, in other interval the aluminium content is ≤ 1.792 mg/kg, Manganese is approximately ≤ 1.095 mg/kg, Iron is approximately ≤ 4.693 mg/kg and Zinc is approximately ≤ 1.693 mg/kg. Whereas other elements were below the limit of quantification



12. Pickle:

The average aluminium content in 0 hours sample is 11.212 mg/kg. However, in other interval the aluminium content is between 8.883 to 16.498 mg/kg, Manganese is between 1.894 to 2.064 mg/kg, Iron is between 17.830 to 20.825 mg/kg and Zinc is approximately ≤ 2.702 mg/kg. Whereas other elements were below the limit of quantification



6. CONCLUSIONS:

1. The specific migration study using simulants at aqueous pH 2.4, neutral pH, and 10% alcoholic solutions indicates that the migration levels of aluminium and other elements are predominantly below the limit of quantification. Heavy metal contents in the analysed food samples remain below quantifiable limits.
2. In case of Aluminium Foil and Semi Rigid Container Samples, there is no significant change in the Aluminium Level, after exposure to 2, 4, 8 & 10 hours when compared with Aluminium level in the freshly prepared food. The Aluminium content observed in freshly packed food in containers and foil is within the PTWI limit (Refer Annexure-1).

7. REFERENCES

- IS 9845 : 1998 ; Determination of overall migration of constituents of plastics materials and articles intended to come in contact with foodstuffs:
- CALF/SOP/CHEM/MMS/07 by ICP-MS (issue no. 05, issue date 11/03/2021): Specific Migration
- COMMISSION REGULATION (EU) No 10/2011
- European Food Safety Authority (EU) for PTWI Calculation

Annexure - 1

Sr.No	Name of Food items with Condition	Aluminium content (mg/kg)	One time serving size (g)	Intake per day (times)	Intake per week (g)	Calculated weekly intake of aluminium (mg)	PTWI Limit per week for 23 kg weight (mg)	PTWI Limit per week for 55 kg weight (mg)	Limit Status
1	Dal-I 0Hr	1.694	200	3	3000	5.082	23	55	below the PTWI limit
2	Dal-II 0Hr	2.859	200	3	3000	8.577	23	55	below the PTWI limit
3	Dal-I 2Hr	3.788	200	3	3000	11.364	23	55	below the PTWI limit
4	Dal-II 2Hr	1.786	200	3	3000	5.358	23	55	below the PTWI limit
5	Dal-I 4Hr	2.722	200	3	3000	8.166	23	55	below the PTWI limit
6	Dal-II 4Hr	2.458	200	3	3000	7.374	23	55	below the PTWI limit
7	Dal-I 8Hr	1.277	200	3	3000	3.831	23	55	below the PTWI limit
8	Dal-II 8Hr	1.892	200	3	3000	5.676	23	55	below the PTWI limit
9	Dal-I 10Hr	3.845	200	3	3000	11.535	23	55	below the PTWI limit
10	Dal-II 10Hr	1.568	200	3	3000	4.704	23	55	below the PTWI limit
11	Cooked Veg-I 0Hr	4.913	150	3	2250	11.05425	23	55	below the PTWI limit
12	Cooked Veg-II 0Hr	3.983	150	3	2250	8.96175	23	55	below the PTWI limit
13	Cooked Veg-I 2Hr	6.079	150	3	2250	13.67775	23	55	below the PTWI limit
14	Cooked Veg-II 2Hr	5.794	150	3	2250	13.0365	23	55	below the PTWI limit
15	Cooked Veg-I 4Hr	7.007	150	3	2250	15.76575	23	55	below the PTWI limit
16	Cooked Veg-II 4Hr	4.969	150	3	2250	11.18025	23	55	below the PTWI limit
17	Cooked Veg-I 8Hr	4.029	150	3	2250	9.06525	23	55	below the PTWI limit
18	Cooked Veg-II 8Hr	3.73	150	3	2250	8.3925	23	55	below the PTWI limit
19	Cooked Veg-I 10Hr	7.037	150	3	2250	15.83325	23	55	below the PTWI limit
20	Cooked Veg-II 10Hr	5.438	150	3	2250	12.2355	23	55	below the PTWI limit
21	Green Salad-I 0Hr	2.939	200	3	3000	8.817	23	55	below the PTWI limit
22	Green Salad-II 0Hr	1.505	200	3	3000	4.515	23	55	below the PTWI limit
23	Green Salad-I 2Hr	2.519	200	3	3000	7.557	23	55	below the PTWI limit
24	Green Salad-II 2Hr	1.421	200	3	3000	4.263	23	55	below the PTWI limit
25	Green Salad-I 4Hr	0.949	200	3	3000	2.847	23	55	below the PTWI limit
26	Green Salad-II 4Hr	1.458	200	3	3000	4.374	23	55	below the PTWI limit
27	Green Salad-I 8Hr	0.149	200	3	3000	0.447	23	55	below the PTWI limit

28	Green Salad-II 8Hr	0.222	200	3	3000	0.666	23	55	below the PTWI limit
29	Green Salad-I 10Hr	0.287	200	3	3000	0.861	23	55	below the PTWI limit
30	Green Salad-II 10Hr	0.349	200	3	3000	1.047	23	55	below the PTWI limit
31	Coconut Chutney-I 0Hr	1.869	100	3	1500	2.8035	23	55	below the PTWI limit
32	Coconut Chutney-II 0Hr	2.029	100	3	1500	3.0435	23	55	below the PTWI limit
33	Coconut Chutney-I 2Hr	2.754	100	3	1500	4.131	23	55	below the PTWI limit
34	Coconut Chutney-II 2Hr	2.333	100	3	1500	3.4995	23	55	below the PTWI limit
35	Coconut Chutney-I 4Hr	3.03	100	3	1500	4.545	23	55	below the PTWI limit
36	Coconut Chutney-II 4Hr	1.934	100	3	1500	2.901	23	55	below the PTWI limit
37	Coconut Chutney-I 8Hr	2.196	100	3	1500	3.294	23	55	below the PTWI limit
38	Coconut Chutney-II 8Hr	1.539	100	3	1500	2.3085	23	55	below the PTWI limit
39	Coconut Chutney-I 10Hr	1.652	100	3	1500	2.478	23	55	below the PTWI limit
40	Coconut Chutney-II 10Hr	1.915	100	3	1500	2.8725	23	55	below the PTWI limit
41	Fruits-I 0Hr	2.123	200	3	3000	6.369	23	55	below the PTWI limit
42	Fruits-II 0Hr	1.275	200	3	3000	3.825	23	55	below the PTWI limit
43	Fruits-I 2Hr	1.273	200	3	3000	3.819	23	55	below the PTWI limit
44	Fruits-II 2Hr	0.709	200	3	3000	2.127	23	55	below the PTWI limit
45	Fruits-I 4Hr	1.201	200	3	3000	3.603	23	55	below the PTWI limit
46	Fruits-II 4Hr	2.261	200	3	3000	6.783	23	55	below the PTWI limit
47	Fruits-I 8Hr	0.004	200	3	3000	0.012	23	55	below the PTWI limit
48	Fruits-II 8Hr	0	200	3	3000	0	23	55	below the PTWI limit
49	Fruits-I 10Hr	1.379	200	3	3000	4.137	23	55	below the PTWI limit
50	Fruits-II 10Hr	2.123	200	3	3000	6.369	23	55	below the PTWI limit
51	Roti-I 0Hr	15.52	100	2	1000	15.52	23	55	below the PTWI limit
52	Roti-II 0Hr	13.51	100	2	1000	13.51	23	55	below the PTWI limit
53	Roti-I 2Hr	13.951	100	2	1000	13.951	23	55	below the PTWI limit
54	Roti-II 2Hr	12.811	100	2	1000	12.811	23	55	below the PTWI limit
55	Roti-I 4Hr	13.26	100	2	1000	13.26	23	55	below the PTWI limit
56	Roti-II 4Hr	13.126	100	2	1000	13.126	23	55	below the PTWI limit
57	Roti-I 8Hr	14.048	100	2	1000	14.048	23	55	below the PTWI limit
58	Roti-II 8Hr	12.549	100	2	1000	12.549	23	55	below the PTWI limit
59	Roti-I 10Hr	13.574	100	2	1000	13.574	23	55	below the PTWI limit

60	Roti-II 10Hr	14.189	100	2	1000	14.189	23	55	below the PTWI limit
61	Puri-I 0Hr	12.48	100	2	1000	12.48	23	55	below the PTWI limit
62	Puri-II 0Hr	11.267	100	2	1000	11.267	23	55	below the PTWI limit
63	Puri-I 2Hr	12.629	100	2	1000	12.629	23	55	below the PTWI limit
64	Puri-II 2Hr	14.42	100	2	1000	14.42	23	55	below the PTWI limit
65	Puri-I 4Hr	11.598	100	2	1000	11.598	23	55	below the PTWI limit
66	Puri-II 4Hr	12.082	100	2	1000	12.082	23	55	below the PTWI limit
67	Puri-I 8Hr	11.728	100	2	1000	11.728	23	55	below the PTWI limit
68	Puri-II 8Hr	11.003	100	2	1000	11.003	23	55	below the PTWI limit
69	Puri-I 10Hr	13.814	100	2	1000	13.814	23	55	below the PTWI limit
70	Puri-II 10Hr	13.222	100	2	1000	13.222	23	55	below the PTWI limit
71	Boil Veg-I 0Hr	1.365	200	3	3000	4.095	23	55	below the PTWI limit
72	Boil Veg-II 0Hr	2.154	200	3	3000	6.462	23	55	below the PTWI limit
73	Boil Veg-I 2Hr	1.724	200	3	3000	5.172	23	55	below the PTWI limit
74	Boil Veg-II 2Hr	4.517	200	3	3000	13.551	23	55	below the PTWI limit
75	Boil Veg-I 4Hr	1.517	200	3	3000	4.551	23	55	below the PTWI limit
76	Boil Veg-II 4Hr	3.056	200	3	3000	9.168	23	55	below the PTWI limit
77	Boil Veg-I 8Hr	0.989	200	3	3000	2.967	23	55	below the PTWI limit
78	Boil Veg-II 8Hr	1.325	200	3	3000	3.975	23	55	below the PTWI limit
79	Boil Veg-I 10Hr	1.197	200	3	3000	3.591	23	55	below the PTWI limit
80	Boil Veg-II 10Hr	1.894	200	3	3000	5.682	23	55	below the PTWI limit
81	Sandwich-I 0Hr	2.939	300	2	3000	8.817	23	55	below the PTWI limit
82	Sandwich-II 0Hr	3.573	300	2	3000	10.719	23	55	below the PTWI limit
83	Sandwich-I 2Hr	4.256	300	2	3000	12.768	23	55	below the PTWI limit
84	Sandwich-II 2Hr	4.467	300	2	3000	13.401	23	55	below the PTWI limit
85	Sandwich-I 4Hr	5.381	300	2	3000	16.143	23	55	below the PTWI limit
86	Sandwich-II 4Hr	5.586	300	2	3000	16.758	23	55	below the PTWI limit
87	Sandwich-I 8Hr	3.077	300	2	3000	9.231	23	55	below the PTWI limit
88	Sandwich-II 8Hr	3.289	300	2	3000	9.867	23	55	below the PTWI limit
89	Sandwich-I 10Hr	2.636	300	2	3000	7.908	23	55	below the PTWI limit
90	Sandwich-II 10Hr	2.337	300	2	3000	7.011	23	55	below the PTWI limit
91	Banana-I 0Hr	1.035	300	3	4500	4.6575	23	55	below the PTWI limit

92	Banana-II 0Hr	0.66	300	3	4500	2.97	23	55	below the PTWI limit
93	Banana-I 2Hr	0.923	300	3	4500	4.1535	23	55	below the PTWI limit
94	Banana-II 2Hr	1.792	300	3	4500	8.064	23	55	below the PTWI limit
95	Banana-I 4Hr	0.969	300	3	4500	4.3605	23	55	below the PTWI limit
96	Banana-II 4Hr	0.759	300	3	4500	3.4155	23	55	below the PTWI limit
97	Banana-I 8Hr	0.19	300	3	4500	0.855	23	55	below the PTWI limit
98	Banana-II 8Hr	0	300	3	4500	0	23	55	below the PTWI limit
99	Banana-I 10Hr	0.101	300	3	4500	0.4545	23	55	below the PTWI limit
100	Banana-II 10Hr	0.258	300	3	4500	1.161	23	55	below the PTWI limit
101	Pickle-I 0Hr	9.195	10	3	150	1.37925	23	55	below the PTWI limit
102	Pickle-II 0Hr	13.228	10	3	150	1.9842	23	55	below the PTWI limit
103	Pickle-I 2Hr	13.669	10	3	150	2.05035	23	55	below the PTWI limit
104	Pickle-II 2Hr	14.112	10	3	150	2.1168	23	55	below the PTWI limit
105	Pickle-I 4Hr	14.341	10	3	150	2.15115	23	55	below the PTWI limit
106	Pickle-II 4Hr	16.498	10	3	150	2.4747	23	55	below the PTWI limit
107	Pickle-I 8Hr	10.087	10	3	150	1.51305	23	55	below the PTWI limit
108	Pickle-II 8Hr	13.597	10	3	150	2.03955	23	55	below the PTWI limit
109	Pickle-I 10Hr	13.169	10	3	150	1.97535	23	55	below the PTWI limit
110	Pickle-II 10Hr	8.883	10	3	150	1.33245	23	55	below the PTWI limit