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THE HARMFUL EFFECT OF APPLES COATED WITH PARAFFIN WAX

KEYWORDS

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ABSTRACT *Apples are coated with conventional wax mixtures, the paraffin as petroleum product and morpholine oleate in wax has many human health damaging effects, specially on liver, lungs, intestinal part, eye, skin etc. The chronic apple users are selected as subjects and demographically matched non users are kept as controls. Their biochemical and pulmonary capacities are measured and found that in users their serum Ca and hepatic status are mostly affected.*

Introduction-The wax applied to apples is usually cited as being Carnauba wax (from the leaves of Brazil's carnauba palm) or shellac, which comes from the secretion of the lac bug of India and Thailand., but sometimes apples are coated with food grade paraffin or other petroleum products.

Research has shown that ursolic acid, major cyclic compound of wax is capable of inhibiting various types of body cells and can serve as a starting material for synthesis of more potent bioactive compounds such as tumour agents. Humans do not have the ability to break down waxes and absorb their various components. The mixture of waxes that is applying on apples now days contains different waxes and mineral oil as anti-microbial compound, mineral oil as anti-microbial compound. Some previous studies said that **Lipid Pneumonitis** (Deposition of Lipid droplets in lungs alveoli with reduced respiratory capacity), **Hypo Prothrombinemias** with **increased bleeding time** and delayed clotting time, **swelling of Intestinal Lymph Nodes,** Foreign-body granulomas or **paraffinomas in the liver,** spleen, or mesenteric lymph nodes have been reported following systemic absorption of waxes and mineral oil. Some reports also say about occurrence of **chronic diarrheal, vomiting, abdominal pain, lassitude, thirst, weakness, oedema, bone pain resulting from osteomalacia, hypocalcaemia, Hypo-Kalemia and weight loss.** But Conventional Wax Coatings contains some harmful chemicals. This is widely used in India for coating apples and other fruits, because it is cheaper. Conventional wax coatings are not digested by the body. But the chemicals in the wax can be absorbed by the body.

In conventional produce additional ingredients are added to the wax such as morpholine oleate. This compound is used to spray the wax onto the fruit. Morpholine is an organic chemical compound having the chemical formula - $O(CH_2CH_2)_2NH$. This heterocyclic features both amine and ether functional groups. Morpholine may be produced by the dehydration of diethanolamine with sulphuric acid. Morpholine is used as a chemical emulsifier in the process of waxing fruit. Morpholine is used as an emulsifier and solubility aid for shellac, which is used as a wax for fruit.Principal symptoms being severe damage to the secreting tubules of the kidney, fatty degeneration of the liver, and necrosis of the stomach glandular epithelium. Long-term oral exposure to morpholine caused fatty degeneration of the liver in rats. Feeding up to 2.5% morpholine oleic acid salt (MOAS) resulted in reduced body weight and renal malfunction in the highest-dose group; otherwise, no effects were seen on physical appearance and general behaviour, and there were no changes in biochemical, pathological, and histological observations showed increased incidences of **inflammation of the cornea, and inflammation and necrosis of the nasal cavity in rats. keratitis, oedema, abrasion, scarring, ulceration with or without neovascularization, and corneal endothelial hyperplasia** were observed.

There are no data on acute toxicity or the effects of short- or long-term exposure to morpholine in the general public. The phenomenon known as blue vision or **glaucopsia,** as well as some instances of skin and respiratory tract irritation, have been described in older reports of occupational exposure to morpholine. When applied to human finger tips, undiluted morpholine causes cracking of the **eponychium and hyponychium about the nail.** The intense stinging sensation makes it impossible to tolerate it on the finger for a sufficient length of time to allow absorption. Diluted morpholine (1:40) is also a mild irritant. – asthma, skin disorders and allergies, chronic respiratory disease, e.g., bronchitis, emphysema , eye disease. pneumonitis, pulmonary oedema, laryngeal oedema, and delayed scarring.

Some previous studies said that Lipid Pneumonitis (Deposition of Lipid droplets in lungs alveoli with reduced respiratory capacity), Hypo Prothrombinemias with increased bleeding time and delayed clotting time, swelling of Intestinal Lymph Nodes, Foreign-body granulomas or paraffinomas in the liver, spleen, or mesenteric lymph nodes have been reported following systemic absorption of chemicals in apple coating wax mixtures. Some reports also say about occurrence of chronic diarrhoea, vomiting, abdominal pain, lassitude, thirst, weakness, oedema, bone pain resulting from osteomalacia and weight loss. Findings from some other studies also disclose a protein-losing enteropathy, steorrhoea, pathologic colon changes associated with featureless radiologic findings. The paraffin and other Morpholine like chemicals interfere with the absorption channel of Calcium and Potassium, thus the chronic exposure results in Hypocalcaemia and Hypo kalaemia.

Hypothesis – Based on the related some previous studies the following hypothesis was made-The chronic use of wax coated apples resulted in mild to moderate hepatic damage, thus abnormal clotting-bleeding time and decreased serum protein status, hampered renal functions ,hypocalcaemia , hypokalemia

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, pulmonary pneumonitis, eye irritation etc.

Methodology-
Experimental Sublets-We selected subjects who are regularly eating apples (Atleast 3-5 /day) and also complaining some respiratory discomfort. About 20 persons from different age groups are selected.

Controls- The family members of the subjects, who are demographically matched, but not eating apples.
(20 persons)

Area- Bilaspur city

Study Duration- April 2011-November 2012.

Biochemical Estimations- Their Chest X-Ray was taken, clotting and bleeding times were estimated by routine capillary glass tube method and ink spot method, stool samples were analysed for steatorrhea by using fat dissolving acids, serum Calcium status was analysed for hypocalcaemia by OCPC method, OCPC (Ortho-Cresolphthalein Complexone) method by using the kit of "Lab Care" in auto analyzer, model no-Star 21 Plus. Serum Potassium was estimated by Electrolytic analyser (star 304). Other physical symptoms like diarrhoea, weakness, oedema, abdominal pain, vomiting, and thirst were listed. Serum Creatinine level was estimated kit of MERCK Company, in auto-analyser. Creatinine in a protein free solution reacts with Alkaline Picraete and produces a red colour complex, which is measured calorimetrically at 520 nm. Imaging of hepatocellular cells of some selected persons was done to conform the presence of fatty liver. The Blood tests were done to assess the serum level of the following enzymes-

- Aspartate aminotransferase (AST or SGOT)
- Alanine aminotransferase (ALT or SGPT)
- Alkaline phosphatase, 5' nucleotidase,
- Gamma-glutamyl transpeptidase (GGT)
- LDH (Lactate dehydrogenase)

Biochemical Auto-analyzer Star 21 was used for the serum level analysis of these enzymes. The estimation kits of Span Diagnostics were used for the quantative analysis.

Spirometry Analysis- For the measurement of pulmonary function tests Spirometry was done. The analysis was done on some selected samples-42 only. Through Spirometry –FVC (Forced Vital Capacity) and FEV (Forced Expiratory Volume in one second) were measured.

FEV_1/ FVC (80-120 %) : Normal
FEV_1/ FVC (60-80 %) : Mild Obstruction
FEV_1/ FVC (40-59 %) : Moderate Obstruction
FEV_1/ FVC (< 40 %) : Severe Obstruction

Peak Expiratory Flow Rate (PEFR)- It was measured by Peak Flow-meter. PEFR is the maximum flow rate attainable anytime during FEV from the position of maximum inspiration. It was recorded in Liters /Second.

The Calculation was based on the following formula-
Daily Variability =

$$\frac{\text{PEFR Evening - PEFR Morning}}{{}^{1}/_{2}\text{ (PEFR Evening + PEFR Morning)}} \times 100$$

1] If variability is > 20% for at least two weeks –asthma is present.
2] If variability is > 40% asthmatic condition is severe.
3] If variability is > 60% it's an urgent condition.

Observations-

Sr	Parameters	Patients	Participated	Controls	Participated	Significant Difference
1.	Serum Creatinine	2.01 mg/dL	20	0.5 mg/dL.	20	1.98
2.	Aspartate aminotransferase (AST or SGOT)	113 Units /L	20	13 units /L	20	1.322
3.	Alanine aminotransferase (ALT or SGPT)	189 Units/L	20	25 /L	20	8.066
4.	ALT/AST Ratio	1.92 ± 1.26	20	0.73 ± 0.14	20	2.09
5.	Alkaline phosphatase	201 U/L	20	46 U/L.	20	1.81
6.	Gamma-glutamyl transpeptidase (GGT)	79 U/L	20	23 U/L.	20	4.41
7.	LDH (Lactate dehydrogenase)	207 U/L	20	152 U/L	20	1.005
8.	Prothrombin time	29 Seconds	20	9.8 seconds.	20	6.93
9.	Total Albumin	1.94 g / dL	20	3.9 g/dL	20	4.56
10.	serum Bilirubin	2.2 mg/dL	20	0.18 mg/dL	20	1.90
11.	Serum Calcium	6.71 mg/dL	20	8.9 mg/dL,	20	
12.	CT	computed tomography showed Fatty Liver	5	Not shown	5	--
13.	Serum Potassium	4.16 mEq/liter		4.56m Eq/liter	--	0.312
14.	MRI	On in-phase GRE images or T1- or T2-weighted echo-train spin-echo images, Higher than normal liver suggests fat deposition in liver	1	Normal MRI	1	--
15.	Clotting Time	16.3 min	20	12 min	20	0.561
16.	Bleeding Time	9.1 min	20	5.3 min	20	0.334

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Results of Spirometry Analysis in Experimental and Controls

Serial	Results of Spirometry Analysis in Patients	Results of Spirometry Analysis in Controls
1	51.17	22.23
2	40.80	14.28
3	37.14	18.44
4	50.90	19.16
5	64.13	21.04
6	65.58	18.81
7	43.18	11.82
8	61.42	19.88
9	40.50	29.18
10	52.45	11.43
11	62.27	19.24
12	44.54	22.11
13	54.51	10.70
14	39.04	14.30

Results of Peak Expiratory Flow Rate (PEFR)

Serial	PEFR In Subjects/day in percentage	PEFR in Controls/day in percentage
1	60.8	10.2
2	22.8	8.4
3	40.4	10.7
4	66.7	11.3
5	26.8	7.3
6	39.0	13.6
7	54.7	16.4
8	25.1	4.6
9	67.5	10.4
10	33.8	12.5
11	57.8	17.4
12	44.2	7.4
13	52.9	15.4
14	37.6	15.4

Conclusions- The hepatic enzymatic profile , serum bilirubin level, serum Albumin of the experimental subjects showed mild to moderate hepato-cellular damage while all the controls have normal liver, also the affected renal health was noticed in experimental subjects as indicated by high creatinine level. The clotting and bleeding time of the studied subjects also elongated due to liver sluggishness. The subjects showed status of hypocalcemia and Hypokalemia due to reduced intestinal absorption due to waxes, Morpholine and other petroleum products. The per day variability in the respiratory capacities in very sensitive indicator of respirator insufficiency, it was observed very high in wax coated users than non user controls [In Users daily variability = 50.454 and in controls = 18].This is due to high respiratory pulsation created by the Pneumonitis.

The average serum Ca level of the subjects was 6.71 mg/dL average, significantly lower than normal values, but serum K was not observed low in an average, even in some users the value was only marginally low. Hypocalcaemia (10%-30%) and hypokalemia (12-17%) Vomiting 24%, diarrhoea 59%, oedema, 12%, lipid pneumonia 21%, weakness 83% was observed. It cannot be said that all these health problems have univeriate association with chronic use of apples coated with wax and mineral oil, more deep and population based study is required, but present study suggest the possibility of association .

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