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Effect of Using Strawberry Juices Supplemented with Citrocid Magnesium to Minimize Urinary Oxalate in Experimental Rats

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THE SUITABILITY of two cultivars of strawberries namely Tamaroza and Chandler were used to prepare strawberry juices and supplemented with citrocid magnesium. Chemical analysis was carried out to determine moisture, total soluble solids, protein, titratable acidity, total sugars, crude fiber, oxalic acid, ash and minerals content. Results indicated that potassium was high and constituted the predominant mineral in the two tested strawberry cultivars. Oxalic acid was 82.72 and 86.73 mg/gm in fresh Tamaroza and Chandler, respectively. Meanwhile,supplementation of strawberry juices with 2,4 and 6% citrocid magnesium was effective in the reduction of oxalic acid content but supplementation with 2.0% was more effective in Tamaroza cultivars.

Sensory evaluation indicated that Tamaroza juice supplemented with 2.0% citrocid magnesium had the highest score and came in the first order for color, taste, odor and general acceptability followed by Chandler strawberry juice compared to all other supplemented juices.

On the other hand, biological evaluation was tested for rats fed on basal diet (control); control plus 1.0 or 2.0 gm dehydrated Tamaroza strawberry (DTS); control plus 1.0 or 2.0 gm dehydrated Chandler strawberry (DCS). Feeding on diets containing 2.0 gm DTS supplemented with citrocid magnesium led to an increase in body weight of animals after 85 days. But, the highest ratio content of calcium was obtained for tibia bone of rats fed on basal diet mixed with 1.0gm DCS. Results also indicated that the average decrement of femur calcium content was 9.45 to 12.53% as a result of feeding with DTS and DCS compared with control diet. Meanwhile, supplementation of dehydrated strawberry juices with citrocid magnesium was effective in improving the bioavailability of calcium and in reducing the oxalate content in rats serum and urine.

Microscopic examination of urine ascertained that uric acid, amorphous materials and calcium oxalate were reduced or completely disappeared by continuous feeding of rats by DTS and DCS supplemented with citrocid magnesium till the end of the experiment (after 85 days).

Keywords: Oxalic acid, Strawberries, Calcium oxalate in urine, Calcium in serum and urine .

Strawberry fruits (*Fragaria xananassa*) are considered one of the major vegetable fruit grown in the Middle East countries. Recently, new strawberry cultivars with a good eating and manufacturing properties were developed. Production of strawberries in Egypt was about 5693 thousand tons (FAO, 2004). High oxalate foods identified to increase urinary oxalate in normal individuals rhubarb, spinach, beets, nuts, chocolate, strawberries, wheat bran and tea (Massey & Sutton, 1993). Meanwhile, Sumathi *et al.* (1995) reported that oxalate, the major renal stone forming constituent, from dietary sources such as spinach, rhubarb; strawberries, tea, etc.

It is generally accepted that oxalates in green vegetables bind calcium (Allen, 1982) but a balance previous data showed that the effect of oxalates on calcium bioavailability is variable and unclear. Previous investigations have utilized metabolic balance to study calcium absorption from calcium rich food such as spinach. Calcium absorption from salts and foods intrinsically labeled with Ca^{45} was determined in the rate model by Weaver *et al.* (1987). On the other hand, Heany & Weaver (1989) mentioned that calcium bioavailability was nearly 10 times greater for low oxalate kale, $CaCO_3$ and $CaCl_2$ than from CaC_2O_4 (calcium oxalate) and spinach (high in oxalates). Oxalic acid is the most effective inhibitor of calcium absorption. Consequently, the amount of dietary oxalate excreted in urine and its role for renal stone formation (Holmes *et al.*, 2001). For decades, a mainstay in the treatment of patients with calcium Ca-urinary stones has been a Ca–restricted diet (Ruml *et al.*, 1997). The fact that a low-Ca diet emerged as a risk factor for Ca oxalate calculi and that a high–Ca diet emerged as a protective factor (Curhan *et al.*, 1997) is still frequently ignored. Thus, evidence suggests that limiting dietary intake of high oxalate foods and increasing calcium intake with meals may reduce urinary oxalate and may decrease renal stone formation (Grentz & Massey, 2002). Moreover, reduction of the Ca content of the diet reliably reduced the amount of Ca excreted in Urine. This reduction was believed-but never proven-to reduce the risk of Ca-stone formation (Von Unruh *et al.*, 2004). They reported also that calcium is the most potent modifier of the oxalate absorption. Although this has been found repeatedly, the exact correlation between calcium intake and oxalate absorption has not been assessed to date. Also, they found that reduction of the calcium supply by 70 mg increased the oxalate absorption by 1.0% and vice versa. Calcium addition beyond 1200 mg/d reduced the oxalate absorption only one-tenth as effectively. The citrocid magnesium plus is composed of magnesium citrate ions both in active form, as well as a standard pyridoxine hydrochloride (vitamin B6), in a well balanced dosage. The citrocid magnesium plus is mainly indicated to inhibit calcium oxalate and stones crystal aggregation, which is due to the excessive citrate ions, inhibit formation of calcium containing crystals by chelating them (D.H.C., 2006). Little information about using citrocid magnesium on oxalic acid and Ca- oxalate in urine, so, the aim of this work was carried out to prepare strawberry juices from Tamaroza and Chandler cultivars, then supplementation with 2,4 and 6 gm citrocid magnesium/100ml juice to evaluate chemical analysis and sensory evaluation of cultivars as well as supplemented strawberry juices. Also, this work shed light on the biological evaluation on male albino rats were undertaken to study the effect of supplementation of dehydrated strawberry juices with citrocid magnesium for minimization of urine oxalate and amorphous phosphate.

Material and Methods

Materials

Twenty kg each of the two cultivars of strawberry vegetables *(Fragaria xananassa)* namely Tamaroza and Chandler used in this study were obtained from Strawberries Center, Faculty of Agriculture, Ain Shams University, Cairo, Egypt.

Citrocid magnesium, peffervescent salt was obtained from Chemical Industries Development Company (CID) Giza, Egypt which composed of magnesium and citrate ions both in active form, as well as standard pyridoxine hydrochloride vitamin (B6) in a well balanced dosage.

Kits of calcium, enzymatic colorimetric determination was obtained from Alcan Co., Egypt.

Preparation of strawberry juices supplemented with citrocid magnesium

Three replicates of each strawberry cultivars (each one kg) after washing and removing of green stems were mixed with 20, 40 and 60gm citrocid magnesium (2,4 and 6 gm/100ml) , then blended in a warring blendor. The obtained mixture was then adjusted to pH 2.2 (with citric acid) which is similar to that of the stomach.

Sensory evaluation

Four sensory characteristics of the strawberry juice supplemented with different levels of citrocid magnessium ranging from 2.0 to 6.0 gm/100ml were evaluated: color, taste, odor and general acceptability. This was performed by 10 members, assigned a score to each characteristic evaluated according to 10-point category scales. Samples were evaluated by each panel member once only (Aparicio Cuesta *et al.*, 1992).

Statistical analysis

Means of data obtained for chemical, biological and sensory attributes of juice samples were evaluated using Dunkan's Multiple range test to identify significant differences at the 0.05 probability ($P< 0.05$) using the statistical analysis system SAS (SAS Institute Inc., 1999) .

The suitable strawberry juice supplemented with 2.0gm citrocid magnesium / 100ml (for two cultivars) was prefered for panelists then dehydrated at 50°C for 24 hr in oven under vacuum was used (1.0 and 2.0gm for Chandler, Tamaroza, respectively) for biological evaluation.

Chemical analysis

Moisture, total soluble solids (TSS), ash, crude fiber and protein contents were determined in the fresh two cultivars of strawberry by the methods of A.O.A.C. (2000). Titratable acidity was determined by the method of Main *et al.* (1986). Total sugars were determined according to the method reported by Ranganna (1979). Some minerals were determined after ashing using atomic absorption spectrophotometer, Perkin Elmer 3300USA according to Kasai *et al.* (1997). Oxalic acid content was determined colorimetrically by the method of A.O.A.C. (2000).

Biological Evaluation

Experimental animals: Male albino rats (Sprague Dawely), weighting 89 in average supplied from Vet. Medicine College, Cairo University were used.

Experimental design: Sixty male albino rats were kept under normal healthy conditions and fed on basal diet for ten days (adaptation period). The composition of the basal diet (gm/100g) according to Reeves *et al.* (1993), containing casein 11.2%; sunflower oil 13.3%; corn starch 66.5%; cellulose 4.00%; salt mix. 4.00% and vitamin mix. 1.00% was used.

After feeding on the basal diet for 10 days, rats were fed on the same diet and divided into five groups (each contained 12 rats): a negative control (basal diet); control + 1.0gm dehydrated tamaroza strawberry (DTS); control +2.0gm (DTS); control + 1.0gm dehydrated chandler strawberry (DCS) and control + 2.0gm (DCS) until hyper salty urine (30 days), then fed on two dehydrated strawberry cultivars (DTS, DCS) supplemented with citrocid magnesium for another 45 days. Feeding was continued for 85 days, during which each rat was weighted at the beginning of experimental period and after 10 days intervals. During the experiment, rats were drunk deionized water and kept separately in well aerated cages (stainless steel). At the end of experiment, rats were fastened overnight and anathesiaed using diethyl ether. Blood samples were taken from the hepatic portal vein. The orbital venous plexuses by capillary tube were transferred into a clean centrifuge tubes. At the end of the experimental period (85 days), the internal organs (liver, kidney, spleen, heart, lung, femur and tibea) were weighted corresponded to their body weight.

Blood samples

Blood samples were centrifuged at 5000 r.p.m. for 15 min to separate serum, then kept in plastic vials at -20°C until analysis within 0-24 hr.

Serum and urine calcium level were analyzed enzymatically by colorimetric procedure kits according to Corns & Ludman (1987).

Urine analysis

Urine strip for urine samples used by Dialab Cat. Nos.: 799900, urine strip - 10 A. 1160 Vienna - Panikengasse 3 - 5, Austria.

Email, Office @dialab at Austria (A.O. A.C., 2000).

Organs. femur and tibea were dried in an oven at 110°C overnight, then (0.5 ± 1.0gm) from samples were hydrolyzed by 6 ml concentrated nitric acid and 1ml perchloric acids and heated at 200°C till the solution was clear, then being dissolved in 50 ml deionized water for determination of calcium using atomic absorption as described by Farinati *et al.* (1995).

Results and Discussion

Chemical analysis

Results in Table 1 revealed that the contents of moisture, crude fiber, protein, oxalic acid, ash and minerals in Tamaroza strawberries were higher comparing with those of the Chandler ones. While, the Chandler strawberries was slightly higher in total soluble solids, titratable acidity and also total sugars. From the same Table, it could be noticed that potassium was higher and predominant mineral in the two tested strawberries followed by phosphorous (P); calcium (Ca); magnesium (Mg); sodium (Na); selenium (Se) and ferrous (Fe), respectively.

Also, oxalic acid content of fresh as well as strawberry juice supplemented with 2.0, 4.0 and 6.0gm citrocid magnesium/100ml were determined. Results showed that oxalic acid (mg/gm) content of fresh Chandler and Tamaroza strawberries were 82.72 and 86.73, respectively.

TABLE 1. Chemical constituents of the two tested cultivars of fresh strawberries.

Chemical composition % *	Strawberry cultivar	
	Chandler **	Tamaroza
Moisture content	86.90 ± 0.28	88.30 ± 1.05
Total soluble solids (T.S.S.)	7.91 ± 0.96	7.86 ± 1.07
Titratable acidity	1.11 ± 0.04	0.89 ± 0.02
Total sugars	6.61 ± 1.73	6.38 ± 1.61
Crude fiber	1.31 ± 0.05	1.51 ± 0.98
Protein content	0.73 ± 0.16	0.80 ± 0.20
Oxalic acid (mg/g)	82.72 ± 1.96	86.72 ± 2.06
Total ash	0.46 ± 0.13	0.48 ± 0.16
Minerals (mg/100g)		
K	176.9 ± 2.17	182.30 ± 2.05
Ca	13.98 ± 2.10	14.86 ± 1.98
Mg	10.63 ± 2.15	11.60 ± 1.95
P	19.86 ± 2.10	20.13 ± 1.93
Na	2.58 ± 2.00	2.63 ± 1.90
Fe	1.14 ± 0.23	1.21 ± 1.08
Se	2.46 ± 0.08	2.58 ± 0.90

* On fresh weight basis ** Values are means of three replicates ± standard deviation.

However, supplementation with 2.0, 4.0 and 6.0% citrocid magnesium caused to reduce oxalic acid content but supplementation with 2.0% was more effective for reduction of oxalic acid recording 38.96 and 43.73% reduction in oxalic acid of fresh Chandler and Tamaroza strawberries, respectively (Table 2). Therefore, the higher reduction of oxalic acid was observed for Tamaroza strawberries supplemented with 2.0% citrocid magnesium.

TABLE 2. Effect of supplementation with citrocid magnesium on oxalic acid content for tested strawberry juices (mg/gm).

Strawberry cultivars	Treatment with citrocid magnesium (gm/100ml)			
	Control	2.0	4.0	6.0
Chandler	82.72	50.49	50.83	53.41
Tamaroza	86.73	48.80	57.26	63.43

Sensory evaluation

In addition to physical – chemical criteria, a set of objective sensory quality criteria that describes the most relevant and most reliable variation for a given product is required (Martens, 1986). Mean values of sensory scores of fresh and supplemented with 2,4 and 6% citrocid magnesium of strawberry juices for both Tamaroza and Chandler cultivars compared with control are shown in Table 3. Analysis of variance showed that Tamaroza juice supplemented with 2.0% citrocid magnesium recorded the highest scores in color, taste, odor and general acceptability compared with control and other supplementation tasted samples.

TABLE 3. Sensory evaluation of fresh and supplemented strawberry juices for tested cultivars with different concentration of citrocid magnesium.

Characteristics	Tamaroza				Chandler			
	Treatment with citrocid magnesium (gm/100ml)							
	Control (zero citrocid)	2.0	4.0	6.0	Control (zero citrocid)	2.0	4.0	6.0
Color (10)	7.8 b	8.7 a	7.5 b	7.6 b	6.8 b	7.3 b	6.8 b	6.3 c
Taste (10)	8.1 a	8.5 a	6.9 b	6.7 b	6.5 c	7.6 b	6.5 c	6.3 c
Odor (10)	7.9 a	7.9 a	6.8 b	6.6 b	6.6 b	7.5 b	6.3 c	6.5 c
General acceptability (10)	8.1 a	8.6 a	7.1 b	6.7 b	6.3 c	7.6 b	6.3c	6.3 c

Means of different samples in the vertical columns are significantly difference of P< 0.05.

On the other hand, there are no-significant difference for all criterion Tamaroza juice supplemented with 4.0 and /or 6.0% citrocid magnesium. Meanwhile, there were a significant difference among Chandler strawberry juice supplemented with various percentage of citrocid magnesium compared with those of control (without supplementation of citrocid magnesium), but, Chandler juice supplemented with 2.0% citrocid magnesium recorded the highest scores of color, taste, odor and general acceptability compared with other investigated Chandler juices. Generally, panelist scores indicated that Tamaroza strawberry juices supplemented with 2.0% citrocid magnesium had the highest palatability scores followed by Chandler supplemented with the same percentage, Tamaroza juice supplemented with 4.0 and 6.0% citrocid magnesium, and both Chandler juice treated with 4.0 and 6.0% (Table 3), respectively. Therefore, panelist scores indicated that Tamaroza juice supplemented with 2.0% citrocid magnesium had the highest and came in the first order followed by Chandler strawberry juice compared with all those supplementation juices and/or control ones.

Biological evaluation

Body weight gain, food efficiency ratio and food intake parameter

Body weight (B.W.), food intake (F.I) and food efficiency ratio (FER) of rats fed for 85 days on various diets containing different concentrations of dehydrated strawberry cultivars (before and after) supplementation with citrocid magnesium powder are summarized in Table 4. There were no significant differences on initial B.W. for rats fed on tested diets up to 10 days of experimental adaptation. Also, there were no difference on B.W. for rats fed on various tested diets for 30 days either using basal diet and basal diet containing different various of 1.0 and / or 2.0 gm DTS and DCS until reaching hyper salty urine. While, the data showed significant differences between the increment of B.W. for rats fed on basal diet and other tested diets containing basal diets and different levels of DTS and DCS between 30 days and 10 days. Where, the higher incremental was observed in B.W of rats fed on basal diet mixing with 2.0gm of DTS (59.97%) followed by both control (49.27%) and basal diet mixed with 1.0 gm DCS (48.13%), both basal diet mixed with 1.0 and/or 2.0gm DTS, respectively. But, there were no significant difference observed between rats fed on all tested diets containing basal diet and various concentrations of DTS and DCS for incremental in daily B.W., except for rats fed on basal diet which recording a difference with other treatments. On the other hand, there were a greater difference in B.W. between rats group fed on DTS and DCS supplementation with citrocid magnesium after hyper salty urine till the end of experiment (85 days). However, the lower B.W. was recorded for rats fed on basal diet mixed with 2.0gm DTS followed by rats fed on basal diet mixed with 1.0gm DCS, both basal diet mixed with 1.0g DTS and 2.0 gm DCS. From the same Table 4, there were no significant differences for rats fed on different tested diets till the end of experiments, meanwhile, there was a significant difference of F.E.R. between rats fed on basal diet only and another tested treatments, but no significant differences in F.E.R for rats fed on all investigated supplemented diets. It was clearly noticed that feeding on diets containing DTS and DCS supplemented with citrocid magnesium, lead to increase in B.W. gain of animals fed for 85 days, especially those fed on 2.0gm DTS compared to normal rats fed on basal diet.

TABLE 4. Nutritional parameters of rats fed on dehydrated strawberry cultivars before and after hyper salty urine.

Treatments	Initial B.W (after 10 days)	B.W. after (30 days)	(3) B.W (A.H.S) urine (85 days)	Daily B.W increase %	B.W. gain after (85 days)	% increment in B.W	Food efficiency Ratio	Food intake (g)
Basal diet (control)	81.67a	121.67a	211.67a	1.807a	130.0a	49.27ab	26.74a	488.04a
Basal diet + 1.0 gm DTS (1)	89.00a	121.25a	183.75b	1.278b	92.0b	37.60b	17.75b	531.86a
Basal diet + 2.0 gm DTS (1)	80.00a	120.00a	151.67c	1.075b	77.5b	59.97a	16.35b	478.08a
Basal diet + 1.0 gm DCS (2)	84.00a	118.33a	161.67bc	1.152b	83.0b	31.73b	17.03b	501.95a
Basal diet + 2.0 gm DCS (2)	87.00a	130.00a	176.67b	1.012b	73.0b	48.13ab	14.18b	519.91a
L.S.D.	12.891	19.642	22.919	0.354	25.411	22.545	6.560	77.043

(1) Rats were fed dehydrated Tamaroza strawberry
(2) Rats were fed dehydrated Chandler strawberry
(3) Body weight after hyper salty urine for rats and fed on supplemented samples till the end of experiment (85 days) (final B.W.).

Internal organs weight

The results in Table 5 showe the average of internal organs relative weights expressed on body weight basis of rats fed for 85 days on basal diet mixed with various contents of DTS and DCS supplementation with citrocid magnesium, compared to internal organs weight of rats fed on basal diet (control). It was clearly noticed that feeding animals on DTS and DCS supplemented with citrocid magnesium caused a significant difference in relative average weights of liver, kidney, spleen, heart and tibea. On the other hand, feeding on the same diets caused no significant differences in lung and femur relative average weights.

TABLE 5. Influence of dehydrated strawberries supplemented with citrocid magnesium on internal organs weight of rats (gm).

Treatments	Liver	Kidney	Spleen	Heart	Lung	Femur	Tibea
Basal diet (control)	7.00a	1.20a	0.30ab	0.70a	1.20a	0.95a	1.35a
Basal diet + 1.0gm DTS	6.50a	0.95ab	0.25b	0.50ab	1.20a	0.80a	1.05ab
Basal diet + 2.0gm DTS	5.35b	1.20a	0.25b	0.45b	0.95a	0.95a	0.50bc
Basal diet + 1.0gm DCS	5.70b	0.90ab	0.30ab	0.35b	0.90a	1.00a	0.65bc
Basal diet + 2.0gm DCS	5.20b	0.65b	0.20b	0.45b	0.95a	1.05 a	0.65bc
L.S.D. 5%	0.324	0.304	0.199	0.215	0.527	0.315	0.650

Means with the same letters in the same horizontal column are not significantly different at 5% level.

Calcium content of rats organs

Calcium balance reflects the difference between calcium intake and calcium excretion. Because humans are not fed a single food in a balance study, calcium absorption from a single food cannot be evaluated. Moreover, calcium in the feces from endogenous secretion is indistingvishable from unabsorbed dietary calcium (Weaver *et al.*, 1987). Table 6 revealed that the effect of rats fed on basal diet (control) and basal diet mixed with tasted dehydrated strawberry juices supplemented with citrocid magnesium on calcium content determined by Atomic Absorption instrument of tibea and femur bones for experimental rats. There was a slight as difference observed in tibea calcium content for rats fed on control diet and all tested diets after the end of experiment for 85 days . But, the higher ratio content of calcium was obtained for tibea bone of rats fed on basal diet mixed with 1.0gm DCS followed by both basal diet (control); basal diet plus 1.0gm DTS; basal diet plus 2.0gm DCS and basal diet plus 2.0gm DTS. Subsequently, results also indicated that the average of decrement was 9.45 to 12.53% for femur calcium content as a result of feeding DTS and DCS on comparing with control diet (Table 6). Such results ascertained that supplementation with citrocid magnesium could not occur to transfer of calcium from serum to bones. These data clearly suggested that oxalic acid binds calcium, rendering it unavailable for absorption as shown by Weaver *et al.* (1987). These results can be explained with the opinion of Morrison & Hark (1996) who mentioned that bone consists of a collagen matrix where minerals are deposited. Most of the body's calcium, phosphorus, and magnesium are deposited in the bones and teeth. Bones also store a reservior of minerals to maintain proper cellular functioning in the event of an intake deficiency. Thus, although minerals are transported via the circulatory system, blood levels of minerals provide limited indication of the actual biochemical flux and body stores of minerals.

TABLE 6. Influence of dehydrated strawberry cultivars supplemented with citrocid magnesium on calcium content in rats organ (mg/100g).

Treatments	Tibea	Femur
Basal diet (control)	16909.6ab	17090a
Basal diet + 1.0gm DTS	13931.0 cd	15474.2b
Basal diet + 2.0gm DTS	15107.2 bc	14948.4bc
Basal diet + 1.0gm DCS	17773.7 a	14564.5bc
Basal diet + 2.0gm DCS	15907.2bc	15041.9b
Mean value	15925.7a	15423.8a

* Means with the same letters in the same horizontal column are not significantly different at 5% level.

Calcium content in serum and urine

The effect of different basal diets mixed with dehydrated strawberry juices supplemented with citrocid magnesium on calcium contents of serum and urine for experimental rats was given in Table 7. Results indicated that, there were no significant difference in calcium of control rats serum during the total period of experiment. Meanwhile, a gradual significant decrease was observed for rats fed on diets mixed with both 1.0 and 2.0 gm DCS and 1.0 gm DTS up to 50 days of biological experiment. Therefore, using those diets for feeding of rats up to 50 days caused to reduce calcium in serum of rats after hyper salty urine. On the contrary, there was a slight increase of calcium in rats serum for rats fed on diet mixed with 2.0 gm DTS. On the other hand, a greater significant increase in calcium content of rats serum for rats fed on all tested diets at the end of experiment (85 days).

TABLE 7. Serum and urine calcium content (mg/dl) of rats fed DCS and DTS mixed with citrocid magnesium for 85 days.

Treatments / Periods	After depletion period (10 days)	After 30 days	After 50 days	After 85 days
Serum calcium *				
Basal diet (control)	10.24 ab	10.17ab	10.14 ab	10.65ab
Basal diet + 1.0gm DTS	10.02 ab	9.50bc	8.50cd	12.40a
Basal diet + 2.0gm DTS	9.39 bc	10.29ab	10.30ab	11.50a
Basal diet + 1.0gm DCS	10.36 ab	10.15ab	8.93cd	13.10a
Basal diet + 2.0gm DCS	11.50 a	11.27a	9.19bc	14.01aa
Urine calcium **				
Basal diet (control)	60.15ab	60.59ab	61.85ab	60.89ab
Basal diet + 1.0gm DTS	53.95bc	6.09cc	16.32cd	31.94db
Basal diet + 2.0gm DTS	60.95ab	14.70cd	16.95cd	108.10aa
Basal diet + 1.0gm DCS	57.20b	8.69de	19.09cc	105.50aa
Basal diet + 2.0gm DCS	59.20ab	18.95cc	18.17cc	133.75aa

Means with the same letters in the same horizontal column are no significantly different at 5% level.

* L.S.D. treatments = 0.527 and L.S.D. for periods = 0.471

** L.S.D. treatments = 1.927 and L.S.D. for periods = 1.723

On comparing the effect of rats fed on basal diet and basal diets mixed with tested dehydrated strawberry juices supplemented with different levels of citrocid magnesium on the calcium of urine rats as seen in Table 7. It could be concluded that, a highly significant decline of calcium in urine of experimental rats occurred as a result of feeding (after 30 days) on diets mixed with both with 1.0 gm and/or 2.0 gm of DTS and DCS comparing with control diets free from citrocid magnesium. On the other hand, a significant increase of calcium in urine occurred for rats fed on all tested diets up to 50 days except for rats fed on control diet. Currently, a greater significantly increase of calcium in urine occured for rats fed on basal diet mixed with 2.0gm DTS and both 1.0 and 2.0 gm DCS compared with those control (basal diet) and /or basal diet mixed with 1.0gm of DTS. In other words, the higher content of calcium in experimental rats urine and serum was observed in rats fed on basal diet (for 85 days) mixed with 2.0 gm DCS followed by 1.0 gm DCS and 2.0 gm DTS, respectively. Results also indicated that supplementation of diets with citrocid magnesium caused to improve the absorption and bioavailability of calcium content and reduce oxalate content in rats serum and urine.

Microscopic examination of urine

The risk of calcium oxalate nephrolithiasis does not increase significantly after calcium or combined calcium and calcitriol supplement in the majority of postmenopausal women with osteoporosis (Domrogkitchaiporn *et al.*, 2000). Also, Morozumi & Ogawa (2000) reported that the higher amount of oxalate in relation to calcium in the diet is, the higher the urinary oxalate excretion is. A low calcium level in the intestine enhanced the uptake of oxalate, leading to hyperoxaluria and calcium oxalate stone formation. The fact that a low calcium diet emerged as a risk factor for ca- oxalate calculi and that a high calcium diet emerged as a protective factor in two large epidemiologic studies (Von Unruh *et al* ., 2004). Table 8 showed the microscopic examination of calcium oxalate, uric acid, amorphous phosphate, triple phosphate and amorphous urate which were determined for rats fed on basal diet and also all tested diets during the experiment period for 85 days. Results showed that the all groups had (++) uric acid, Am, urate and also normal range of uric acid after depletion period (10 days). Group of rats fed on basal diet (for 30 days) plus 1.0 gm DTS, DCS and 2.0gm DCS had higher content of calcium oxalate (Table 8). On the other hand, a greater disappearance of calcium oxalate for rats fed on all supplemented tested diets at the end of experiment (85 days) occured. It was ascertained that rats fed on DTS and DCS mixed with citrocid magnesium for 85 days could reflect the normal urine report in different groups of rats except for the control group which showed Amorphus phosphate and also rats fed on basal diet plus 1.0gm DCS. Generally, it could be concluded that uric acid, Am. materials and calcium oxalate were reduced or completely disappeared by continuous feeding of rats for diets supplemented with citrocid magnesium till the end of experiment (after 85 days). Finally, it was also clearly noticed that supplemented diets with citrocid magnesium was the most promising to reduce or minimize Ca-oxalate of strawberry juices closed to that of the control sample.

TABLE 8. Microscopic examination of urine for male albino rats fed on (DTS) and (DCS) supplemented with citrocid magnesium for 85 days.

	Adaptation period		after depletion period for rats fed DTS and DCS				After hyper salty urine for rats fed DTS and DCS supplemented with citrocid magnesium for			
	10 days		20 days		30 days		40 days		85 days	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Basal diet (control)	Uric acid (++)	Am. Urate (++)	Am phosphate	(++)Am. phosphate	Am phosphate	Phosphate (++)	Triple phosphate (++)	(+) Triple phosphate	Am. phosphate (++)	(+)Am. phosphate
Basal diet + 1.0 gm DTS	Nil	Am. Urate (few)	Calcium oxalate	Am. phosphate (++)	Calcium oxalate (++)	Phosphate (++)	Nil	Am. phosphate (+)	Nil	Nil
Basal diet + 2.0 gm DTS	Uric acid (+)	Am. Urate (+++)	Am. phosphate	(+) Am. phosphate	Calcium oxalate (++)	Phosphate (+++)	Nil	Phosphate (+)	Nil	Few
Basal diet + 1.0 gm DCS	Nil	Am. Urate (++)	Am. phosphate	(++)Am. phosphate	Nil	Phosphate (+)	Nil	Am. phosphate (+)	Nil	Am phosphate (+)
Basal diet + 2.0 gm DCS	Uric acid (++)	Am. Urate (+++)	Am. phosphate	(+)Am. phosphate	Calcium oxalate (+++)	Am. phosphate (+)	Nil	Am. phosphate (++)	Nil	Few

(1) Crystals (normal range was nil)
(2) Amorphous Material (normal range was nil).

References

Allen, L.H. (1982) Calcium bioavailability and absorption: *A Review Am. J. Chin. Nutr.* **35** , 783.

A.O.A.C. (2000) Association of Official Analytical Chemists. *Official Methods of Analysis.* 16th ed., Gaithers Burg, M. D. U. S. A..

Aparicio- Cuesta, M.P., Mateos-Notario M.P. and Rivas-Gonzalo, J.C. (1992) Sensory evaluation and changes in peroxidase activity during storage of frozen green beans. *J. Food Sci.* **57** (5), 1129.

Corns, C. and Ludman, C. (1987) *In vitro* diagnóstic use for enzymatic colorimetric, method for determination of calcium. *Anal. Clin. Biochem.* **24**, 345.

Curhan, G.C., Willett, W.C. and Speizer, E.E. (1997) Comparison of dietary calcium with supplemented calcium and other nutrients as factors affecting the risk for kidney stones in women, *Amn. Intern. Med.* **126, 497**.

D.H.C. (2006) Drug Holding Company Hold Farma, Citrocid magnesium plus, *Http://www.DrugHolding.org,* Page 66. htm.

Domrogkitchaiporn, S., Ongphiphadhanakul, B., Stitchantrakul, W., Piaseu, N. and Rajatanavin, R. (2000) Risk of calcium oxalate nepherolithiasis after calcium or combined calcium and calcitriol supplementation in postmenopausal women. *Osteoporos Int.*11 (6), 486. *C.F. http://* www.pubmed.com (2006).

Farinati, F., Cardin, R.,Maria, N., Lecis, P. Dall, G. and Burra, P. (1995) Zinc, iron and peroxidation in liver tissue. *Biological Trace Element Research*, **47**, 193.

F.A.O. (2004) Food and Agriculture Organization. *FAO Production Year Book*, Vol. **55**.

Grentz, L. and Massey, L.K. (2002) Contribution of dietary oxalate to urinary oxalate in health and disease. *Topics in Clinical Nutrition*, **17**, 2, 60.

Heaney, R.P. and Weaver, C.M. (1989) Oxalate: Effect on calcium absorption. *Am. J. clin. Nutr.* **50**, 830.

Holmes, R.P., Goodman, H.O. and Assimos, D.G. (2001) Contribution of dietary oxalate to urinary oxalate excretion, *Kidney Int.* **59** , 270.

Kasai, M., Okamoto, N., Hatne, K. and Shimada, A. (1997) Role of calcium and Magnesium ions in the hardening of pressure treated root vegetables. *J. Agric. Food Chem.* **45**, 599.

Main, G.L., Morris, J.R. and Wehunt, E.J. (1986) Effect of processing treatments on the firmness and quality characteristics of whole and sliced strawberries after freezing and thermal processing. *J. Food Sci.* **51** (2), 391.

Martens, M. (1986) Sensory and chemical /physical quality criteria of frozen peas studied by multivariate data analysis. *J. Food Sci.* **51**, 599.

Massey, L.K. and Sutton, R.A.L. (1993) Modification of dietary oxalate and calcium reduces urinary oxalate in hyperoxaluric patients with kidney stones, *J. Am. Diet. Assoc.* **93**, 11, 1305.

Morrison, O.M.D. and Hark, L. (1996) *"Medical Nutrition and Disease"*, Chapter 2. Vitamin and mineral therapy, p. 57. Blackwell Science, Inc., USA.

Morozomi, M. and Ogawa, Y. (2000) Impact of dietary calcium and oxalate ratio on urinary stone formation in rats. *Molurol.*; 4 (4), 313, *C.F. http:// www.pubmed.com*, (2006).

Ranganna, S. (1979) *"Manual of Analysis Fruit and Vegetable Products"*. pp. 150-161, Total Mc Graw Hill Publishing Company Limited, New Delhi.

Reeves, P.G., Nelson, F.H. and Fahmy, G. (1993) Purified diets for laboratory rodents. *J. Nutr.* **123**, 1939.

Ruml, L.A., Pearle, M.S. and Pax, C.Y.C. (1997) Medical therapy-calcium oxalate urolithiasis, *Urolclin North Am.* **24**, 117.

S.A.S. Institute Inc. (1999) *Statistical Analysis System User's Guide: Statistics*, SAS Institute INC. Editors, Cary, NC.

Sumathi, R., Jayanthi, S. and Varalakshmi, P. (1995) Impaired lipid metabolism in calcium oxalate stone forming rats and DL. Alpha – lipoic acid supplementation. *Nutrition Research*, **15** (1) 59.

Von Unruh, G.E., Voss, S., Sauerbruch, T. and Hesse, A. (2004) Dependence of oxalate absorption on the daily calcium intake. *J. Am. Soc. Nephrol.* **15**, 1567.

Weaver, C.M., Martin, B.R., Ebner, J.S. and Krueger, C.A. (1987) Oxalic acid decrease calcium absorption in rats. *American Institute of Nutrition*. pp. 1933-1906.

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تأثير استخدام عصائر الفراولة المدعومة بستروسيد الماغنسيوم على الحد من ترسيب الأملاح في بول حيوانات التجارب

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تهدف هذه الدراسة إلي إمكانية تدعيم عصير الفراولة صنفي تماروزا و شندلر بستروسيد الماغنسيوم . وتم إجراء التحليلات الكيمائية (رطوبة- مواد صلبة ذائبة- بروتين- حموضة كلية- سكريات كلية- الياف خام- حمض الاوكساليك والرماد والمعادن). وأثبتت النتائج إحتواء أصناف الفراولة علي أعلي نسبة من عنصر البوتاسيوم وأيضا كانت نسبة حمض الأوكساليك في صنف تماروزا و شندلر الطازجة تعادل ٨٢,٧٢، ٨٦.٧٣ ملجم/جم .

كذلك عصير الفراولة صنف تماروزا والمحتوى علي ٢٪ ستروسيد ماغنسيوم إنخفض محتواه من حمض الأوكساليك بالإضافة إلى حصوله علي أعلي درجات التقييم الحسى. وبدراسة التقييم البيولوجي أثبتت الدراسة ان زيادة محتوى الوجبة من الفراولة المجففة المدعومة بستروسيد الماغنسيوم حسن من الكفاءة الحيوية للكالسيوم وكذلك معدل امتصاص الكالسيوم في العظام بالإضافة إلي خفض معدل ترسيب الأوكسالات في سيرم وبول حيوانات التجارب. واخيرا أكدت نتائج الفحص الميكروسكوبى لبول حيوانات التجارب المغذاه علي الفراولة المجففة المدعومة بستروسيد الماغنسيوم لمدة ٨٥ يوم إختفاء أوكسالات الكالسيوم وكذلك أملاح حمض البوليك وغيرها.