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Purine content of some Philippine foods

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To facilitate dietary advice for prevention and management of hyperuricemia, the content of individual purines, namely: adenine, hypoxanthine, guanine and xanthine, was determined in market samples of 16 legumes and dried beans, 41 organ meats, and 25 finfishes and shellfishes using Waters HPLC Model ALC/GPC 244. Analysis for moisture, protein and purines were conducted on the slurries or dried forms of the edible portions of the food samples. Food samples were subsequently classified into three categories adapted from Williams' dietary guide for purines, expressed in decreasing levels of total purines per 100 g serving. Category 1 foods are those that contain very large amount (150 to 1000 mg) of total purines; Category 2 foods are those that contain a large amount (75-<150 mg) of total purines; and Category 3 foods are those that contain a moderate amount (up to 75 mg) of total purines.

Key Words: adenine, hypoxanthine, guanine, xanthine, hyperuricemia, HPLC

PURINES ARE CONSTITUENTS OF NUCLEOPROTEINS FOUND IN ALL LIVing cells; in higher amounts in glandular meats and meat extractives and in lesser amounts in plant sources (1). Purines are obtained from the diet, from the breakdown of body nucleic acids and from synthesis in the liver from smaller metabolic fragments (2). While 90% of the purines obtained from the stepwise enzymatic degradation of endogenous nucleic acids are reincorporated into nucleic acids for reuse, only a few of the purines derived from dietary nucleic acids are reutilized for the formation of endogenous nucleic acids. Most are degraded to xanthine and ultimately to uric acid (3). Excessive uric acid in the blood leads to hyperuricemia which is associated with gouty arthritis (4). The condition is also characterized by the deposition of urate crystals in the soft tissues and in the cartilages of the joints (5). In extreme cases, bone destruction or bone deformity results (2). Elevation of blood uric acid is influenced by such factors as: increased purine ingestion/absorption or impairment of purine metabolism, increased uric acid synthesis, accelerated nucleic acid turnover, decreased renal and gastro-intestinal excretion, and diminished endogenous destruction of urates (6,7). A high-purine diet normally obtained from substantial meat intake increases the urinary uric acid by approximately 0.5 to 0.7 mg per mg of ingested purines (8). Atherosclerosis, hypertriglyceridemia, hypertension and diabetes mellitus are risks endangering the health of a hyperuricemic person (7).

Some studies reported increased uric acid at higher levels of dietary protein (8). A dietary intake of 1 g per kilogram body weight (or 70-80 g/day) is recommended for patients with hyperuricemia and gout (8). Recent nutrition surveys of Filipino households indicated protein intakes of 50.5 g/day (9).

It has been reported that individual purines have varying physiological effects. Adenine and hypoxanthine are the purines found to be conducive to elevation of uric acid level in the blood (10). While the maximum safe level of adenine, which has no adverse effects on the growth of rats, was found to be less than 0.1% in rat diets, the corresponding safe limit for hypoxanthine is not known (11).

Bayani-Sioson and Healy (12) made the presumption that many Filipinos have less efficient system for the excretion of uric acid which cannot compensate for the stress of a high-purine diet. This was supported by the findings of Flores et al. (7). As the diet of Filipinos include more purine-rich foods, hyperuricemia and gout will likely become common (12). Thus, data on purines become necessary. However, no information is available on the levels of purines of local foods normally consumed by Filipinos. Foreign literature is, likewise, inadequate in these data. This study was thus designed to identify foods with very large, large, and moderate amounts of purines, for dietary prevention and management of hyperuricemia.

Experimental

Sampling. The samples of 16 legumes and dried beans, 14 organ meats, and 25 finfishes and shellfishes in this study were selected on the basis of foreign data identifying potentially high sources of purines (1). Adequate amounts of hog and cattle organ meat samples in their fresh state were bought from 2 collection sources, Paco and Divisoria markets at 2 collection periods. The rest of the samples were bought from 1 source only.

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Sample Preparation. Samples were cleaned and edible portions were separated for analysis. Slurries were prepared by cutting the edible portion (flesh of organ meats, or flesh, skin, liver of fishes) into small pieces and homogenizing these in a Waring blender prior to extraction and analysis of the purine components. For legumes, slurries were dried and moisture analysis was done on the fresh and dried samples before protein and purine determinations. The dried beans were ground and analyzed without pretreatment or preparation into slurries.

Chemical Analysis. Moisture and protein analyses were based on the procedures prescribed by the AOAC (13) while analysis of purines (Fig. 1) was adopted from the method of Clifford and Story (11) with some modifications introduced by the authors. Each sample was homogenized with cold (6°C-10°C), 1 N perchloric acid, heated for 1 hr at 100°C, then cooled in an ice bath and centrifuged at 3,000 rpm for 20 min at 0°C-4°C. One to 5 µl of the supernatant previously passed through aqueous millipore filter (0. 45 µm) was injected in Waters ALC/GPC 244 Liquid Chromatograph (with a C18 reverse phase µBondapak column and µBondapak C18 µCorasil guard column). Separations were performed isocratically with 4% KH_2PO_4 at pH 4.06 using a flow rate of 1.2 ml/min. The purines were detected at 254 nm and absorbance peaks were quantified using Data Module 730. The identification of guanine, hypoxanthine, xanthine and adenine was based on the retention time of the standard. The method was validated for accuracy (recovery by spiking) and precision (day-to-day repeatability).

Data Analysis. The food items were grouped accordingly, thus: legumes and dried beans, organ meats and finfishes and shellfishes. For ease of visualization, data obtained based on 100 g raw weight were converted to cooked weight counterparts using FNRI conversion factors corrected only for weight, not analyte, losses.

Using SPSS computer program, analysis of variance in a completely randomized design and t-tests were carried out on data of organ meats of hog and cattle to determine differences in purine content between samples collected from 2 markets at 2 collection periods.

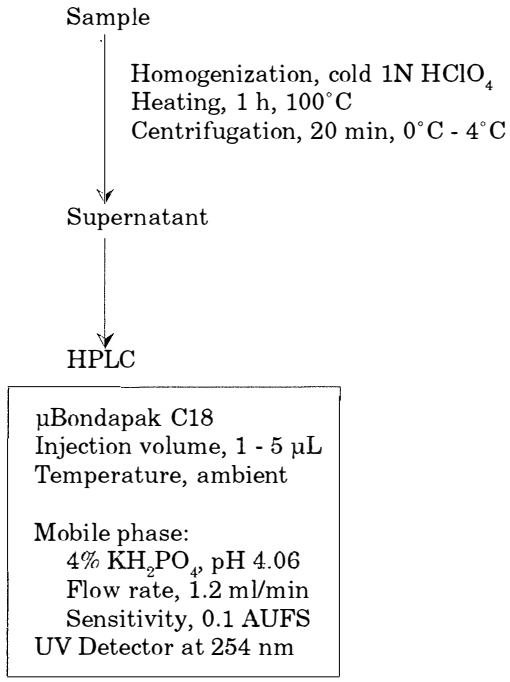

Figure 1. Flow chart of HPLC analysis of purines in foods.

Evaluation Criteria. In order to facilitate dietary advice for the prevention and management of hyperuricemia foods were classified into 3 categories according to purine content per 100 g serving adapted from Williams' dietary guide (Table 1).

Results and Discussion

Attributes of the HPLC method. The attributes of the HPLC method for purine analysis, as shown in Table 2, indicate the reliability and validity of the purine analytical method used. No interlaboratory comparison for purines was possible as there were no other laboratories doing

Table 1. Classification of foods according to total purine content*

Category	Total Purines		Inclusion/Exclusion in Diet
	Amount (mg/100 g)	Description of Amount	
1	150-1000	Very large amounts	All foods to be excluded from diet
2	75-<150	Large amounts	1 food item can be included in diet once a week
3	< 75	Moderate amounts	1 food item can be allowed 4x a week

* Williams, R. , ref. 1.

Table 2. Attributes of the HPLC method for purine analysis.

Attribute	Adenine	Hypoxanthine	Guanine	Xanthine
Sensitivity (pmole/µl)	81.2	11.4	8.8	71.0
Accuracy (% recovery)				
From standard	98	95	95	99
From spiked sample	95	92	92	93
Reproducibility of retention time (CV)	1.49	1.75	1.34	1.93
Within-run reproducibility in foods (range of CV)	0.20-5.00	0.08-4.00	0.05-4.00	0.04-5.00

purine analysis in foods at the time of this study. Furthermore, the lack of standard reference material(s) for purine analysis limited method validation to recovery test by spiking to establish accuracy, and to repeated assays on different days to generate precision data in retention time and purine content.

Classification of Foods According to Evaluation Criteria. Table 3 shows the food samples classified according to decreasing level of total purines. Total purines represent the sum of adenine, hypoxanthine, guanine and xanthine.

Table 3. Classification of foods adapted from Williams' criteria (1).

Category 1 Very large;150-1000 mg Total purines/100 g	Category 2 Large; 75-<150 mg Total purines/100 g	Category 3 Moderate; <75 mg Total purines/100 g
		Legumes & dried beans (all)
Organ meats	Organ meats	Organ meats
Hog: liver, spleen, small and large intestines	Hog: lung, kidney, tongue, heart	Hog: uterus, blood
Cattle: liver, spleen	Cattle: lung, uterus, kidney, heart, brain, reticulum	Cattle: small and large intestines, blood, tripe, ommasum
Carabao: liver, spleen	Carabao: lung, kidney, tripe, reticulum	Carabao: uterus, small and large intestines, trip, omassum
Chicken: liver, kidney gizzard, intestine		
Finfishes & shellfishes*	Finfishes & shellfishes*	
Alumahan	Dalagang bukid	
Bangos	Galunggong	
Dilis	Halaan	
Matang-baka	Hasa-hasa	
Tamban	Hipon, puti	
Tanigi	Lapu-lapu	
Tunsoy	Maya-maya	
Bisugo	Pusit	
Tulingan	Tahong	
	Tambakol	
	Talaba	
	Tilapya	
	Tulya	
	Tuwakang	

* See Table 6 for English names.

While all legumes and dried beans fall exclusively under Category 3, organ meats are distributed in all 3 categories, with liver and spleen of the 4 animal species dominating Category 1. Majority of the finfishes and all of the shellfishes belong to Category 2 while the other finfishes are classified under Category 1.

Purine Content of the Food Items. Legumes and Beans. The total purines of legumes and beans range from 15.8 mg per 100 g for winged bean, *Psophocarpus tetragonolobus*, to 65.3 mg per 100 g for red cowpea, *Vigna sinensis* (Table 4). These foods can be included in the diets of hyperuricemic persons.

Organ Meats. The purine content of organ meats differ from one animal species to another. In Table 5A, highest levels of total purines are found in hog (i.e. liver, small intestine and spleen) and in cattle (i.e. liver and spleen). Predominant purines are adenine and guanine although guanine is the lowest among purines in the blood of both animals. Adenine is more concentrated in the spleen (0.1%) which exceeds the level of this purine considered

Table 4. Protein (g) and purine (mg) contents of legumes and dried beans per 100 g cooked food.

Food item	English name	Protein g	Adenine mg	Hypoxanthine mg	Guanine mg	Xanthine mg	Total purines mg
1. Gisantes, buto, tuyo	Green pea	11.0	28.5	6.5	27.8	4.6	67.4
2. Paayap, pula, buto, tuyo ***Vigna sinensis Linn***	Cowpea, red	12.4	26.4	6.2	28.1	4.6	65.3
3. Paayap, itim, buto, tuyo ***Vigna sinensis Linn***	Cowpea, black	12.7	25.2	5.9	26.4	4.4	61.9
4. Sitaw, puti,buto, sariwa ***Vigna sesqui pedalis Fruw***	Yard-long bean	11.6	21.2	6.3	28.4	3.3	59.2
5. Munggo, berde, tuyo ***Phaseolus aureus***	Mungbean, green	9.1	22.5	5.5	24.6	5.1	57.7
6. Paayap, puti, buto, tuyo ***Vigna sinensis Linn***	Cowpea, white	11.7	24.5	5.6	22.4	4.2	56.7
7. Tapilan, buto, tuyo ***Phaseolus calcaratus***	Rice bean	9.1	24.9	5.1	21.3	4.1	55.4
8. Munggo, dilaw, buto, tuyo ***Phaseolus aureus***	Mungbean, yellow	9.1	22.9	5.1	21.8	4.7	54.5
9. Kadyos, buto, tuyo ***Cajanus cajan***	Pigeon pea	11.6	14.9	6.2	23.9	2.2	47.2
10. Sitsaro, bunga, sariwa ***Pisium sativum***	Pea	3.5	14.1	1.9	11.9	8.3	36.2
11. Abitsuelas,puti, buto, tuyo ***Phaseolus vulgaris Linn***	White kidney bean	9.7	16.3	2.4	14.7	2.1	35.5
12. Abitsuelas,pula, buto, tuyo ***Phaseolus vulgaris Linn***	Red kidney bean	10.8	14.6	2.6	14.0	2.0	33.2
13. Garbansos, buto, tuyo ***Cicer arietinum Linn***	Chickpea	9.5	12.7	2.9	14.2	1.7	31.5
14. Bataw, bunga, sariwa ***Dolichos lablab var. philippinensis***	Hyacinth bean	2.2	9.8	2.7	10.8	7.0	30.3
15. Patani, buto, sariwa ***Phaseolus lunatus Linn***	Lima bean	6.2	13.9	2.3	10.9	0.9	28.0
16. Sigarilyas,bunga, sariwa ***Psophocarphus tetragonolobus Linn***	Winged bean	2.9	5.5	1.4	7.4	1.5	15.8

Table 5. Protein (g) and purine (mg) contents of organ meats/100 g cooked food

A. Hog and Cattle

Organ meat	Protein		Adenine		Hypoxanthine		Guanine		Xanthine		Total purines	
	Hog	Cattle	Hog	Cattle	Hog	Cattle	Hog	Cattle	Hog	Cattle	Hog	Cattle
1. Liver	27.5^{NS}		67.0*	55.1	29.9	0.0	102.3*	71.2	25.9*	33.3	225.1*	159.6
2. Lungs	22.0^{NS}	23.7	56.3^{NS}	57.6	29.0	0.0	57.5^{NS}	63.8	3.7*	13.8	146.5*	135.2
3. Uterus	17.6*	23.6	12.8*	31.4	10.3^{NS}	11.7	18.8*	33.3	1.5*	12.8	43.4*	89.2
4. Kidney	21.7^{NS}	24.0	42.9^{NS}	42.5	40.2*	10.5	54.3*	41.2	2.7*	25.9	140.1*	120.1
5. Large intestine	10.5^{NS}	11.2	29.4*	8.2	11.8^{NS}	7.6	34.7*	11.0	2.6*	4.2	78.5*	31.0
6. Small intestine	17.7^{NS}	18.1	69.2*	21.8	27.5*	12.2	76.6*	26.7	10.0^{NS}	7.2	183.3*	67.9
7. Tongue	26.1*	22.2	27.5*	14.9	56.9*	38.2	30.2*	14.8	0.8*	22.5	115.4*	90.4
8. Blood	15.2*	23.8	1.1^{NS}	1.0	7.8*	0.6	2.2^{NS}	1.4	0.1^{NS}	0.2	11.2*	3.2
9. Spleen	25.9^{NS}	27.5	113.5*	91.1	58.1	0.0	120.5*	92.1	3.0*	36.1	295.1*	219.3
10. Heart	25.2^{NS}	26.0	19.8^{NS}	20.4	58.5*	71.4	20.0^{NS}	19.7	1.5*	16.3	99.8*	127.8
11. Brain	16.8^{NS}	15.9	13.5*	18.2	35.1*	34.2	19.4*	21.0	7.5*	10.4	75.5*	83.8
12. Tripe	-	26.2	-	15.8	-	18.0	-	14.4	-	15.1	-	63.3
13. Omassum	-	21.1	-	10.1	-	2.3	-	12.2	-	4.4	-	29.0
14. Reticulum	-	17.2	-	16.2	-	28.5	-	16.0	-	26.9	-	87.6
15. Intestine	-	-	-	-	-	-	-	-	-	-	-	-
16. Gizzard	-	-	-	-	-	-	-	-	-	-	-	-

Test of significance between hog and cattle organ meat: NS - not significant * = significant at P < . 05

B. Carabao and Chicken

Organ meat	Protein		Adenine		Hypoxanthine		Guanine		Xanthine		Total purines	
	Carabao	Chicken	Carabao	Chicken	Carabao	Chicken	Carabao	Chicken	Carabao	Chicken	Carabao	Chicken
1. Liver	14.3	30.7	59.5	99.9	0.0	0.0	95.7	169.9	34.1	58.1	189.3	327.9
2. Lungs	24.1		47.1		0.0		50.0		18.3		115.4	
3. Uterus	25.8		13.5		0.0		8.0		9.9		31.4	
4. Kidney	23.8	23.2	23.4	203.9	0.9	82.7	29.2	208.5	21.5	48.2	75.0	543.3
5. Large intestine	6.3		1.8		0.0		2.5	0.0		4.3		
6. Small intestine	18.5		16.6		0.0		20.2	6.2		43.0		
7. Spleen	10.7		98.4		0.0		109.2		19.2		226.8	
8. Heart	23.9		18.1		61.4		18.1		17.6		115.2	
9. Brain	16.3		14.4		27.0		16.7		8.5		66.6	
10. Tripe	29.4		9.2		9.1		8.0		14.3		40.6	
11. Omassum	25.5		15.3		4.1		15.7		2.0		37.1	
12. Reticulum	24.0		31.5		22.7		39.8		3.9		97.9	
13. Intestine		15.9		61.3		12.4		82.5		21.8		178.0
14. Gizzard		27.8		52.7		47.3		68.6	13.5		182.1	

safe for the growth of rats (11). Livers, unlike spleen or kidney are usually prepared as a single dish in the Filipino diet. Consumption of too much liver may pose some risk to the A and B population groups who can afford to buy liver.

Generally, there are more hog than cattle organ meats with significantly ($P<0.05$) higher individual and total purines. Common purines in hog liver, large and small intestines, tongue and spleen are adenine and guanine while in kidney, small intestine, blood and brain, hypoxanthine is common. All these individual purines are significantly higher in the hog than in the cattle. With the exception of blood and small intestine, cattle organ meats have significantly higher xanthine than hog organ meats. Xanthine and guanine are not known to produce elevations in uric acid when administered to patients with hyperuricemia (8,16). Hypoxanthine is undetectable in the liver, lung and spleen of cattle.

Adenine is likewise concentrated in the chicken liver (0.1%) and kidney (0.2%) and carabao spleen (0.1%) (Table 5B). These levels are considered unsafe for the growth of rats (11). On the other hand, hypoxanthine is not detectable in the liver, lungs, uterus, large and small intestine and spleen of carabao and in the liver of chicken. In contrast, adenine, guanine and xanthine levels of the same liver and spleen samples are high.

Broiling and boiling are known to extract large amounts of hypoxanthine from tissues (10,14). Although hypoxanthine crystalline compound has a solubility in water of 1.4 g/100 ml at 100°C (15), binding effects could limit its complete leaching from tissues into the boiling water. Moreover, prolonged boiling may bring about destruction of hypoxanthine, but this is not known.

Although intake of xanthine reduces the free adenine-to-guanine ratio in the liver, and dietary guanine increases the amount of free guanine in the same organ (11), these effects are not known in the other organ meats. On this basis, it would be prudent to assume some margin of safety from the liver of the 4 animal species of the present study, on the basis alone of its higher guanine than adenine content.

Finfishes and Shellfishes. Purines in marine products (Table 6) are lowest in lapu-lapu, *Epinephelus corallicola* (86.6 mg per 100 g) and highest in tanigi, *Cybium commerson* (191.4 mg per 100 g) and *tunsoy, Sardinella fimbriata* (191.2 mg per 100 g). Except for some shellfishes, the total purines in these marine products are primarily contributed by hypoxanthine (51.8 to 124.3 mg per 100 g).

Purines in a Typical Filipino One-Day Diet. The typical Filipino one-day diet (17) is a combination of finfishes, beans, leafy and fruit vegetables, root crops and eggs with rice, bread, fruits, coffee and milk (Table 7). From its ingredient composition, (Table 8), the major sources of purines are *tulingan*, dried *galunggong, alumahan, bagoong and munggo,* which diet gives a purine content of 120 mg and protein content of 48.0 g. This diet with its low purine and protein contents apparently provides a margin of safety for both normal and hyperuricemic patients.

Table 6. Protein (g) and purine (mg) contents of fishes and shellfishes per 100 g cooked food.

	Food item	English name	Protein g	Adenine mg	Hypoxanthine mg	Guanine mg	Xanthine mg	Total purines mg
1.	Tanigi ***Cybium commerson***	Spanish mackerel	26.9	11.2	122.9	57.3	0.0	191.4
2.	Tunsoy ***Sardinella fimbriata***	Fimbriated herring	22.0	10.7	116.1	64.4	0.0	191.2
3.	Bangos ***Chanos chanos***	Milkfish	26.2	12.7	124.3	37.6	3.3	177.9
4.	Galunggong ***Decapterus macrosoma***	Big-eyed round scad	26.8	14.8	116.6	41.1	4.4	176.9
5.	Tulingan ***Auxis thazard***	Tuna bonito	24.7	15.7	113.9	35.0	8.2	172.8
6.	Matang-baka ***Caranx crumenophthalamus***	Big-eyed scad	26.6	11.5	102.0	55.9	0.0	169.4
7.	Bisugo ***Nemipterus taeniopterus***	Ribbon-finned nemipterid	21.5	6.4	82.4	76.3	1.6	166.7
8.	Alumahan ***Rastrelliger chrysozonus***	Striped mackerel	28.2	9.1	106.5	41.8	1.6	159.0
9.	Tamban ***Sardinella***	Indian sardine	26.2	8.1	97.5	50.7	0.0	156.3

continued

Table 6 *continued*

Food item	English name	Protein g	Adenine mg	Hypoxanthine mg	Guanine mg	Xanthine mg	Total purines mg
longiceps							
10. Dilis ***Stolephorus commersonii***	Long-jawed anchovy	20.7	18.4	88.0	40.1	4.2	150.7
11. Hipon, puti ***Meta penaeus sp.***	Shrimp, white	25.9	21.9	102.0	19.8	5.4	149.1
12. Hasa-hasa ***Rastrelliger brachyosomus***	Short-bodied mackerel	25.2	9.3	96.7	40.7	1.6	148.3
13. Tambakol ***Neothunus macropterus***	Yellow-fin tuna	29.1	14.5	106.7	20.7	6.0	147.9
14. Hipon, suwahe ***Meta penaeus sp.***	Shrimp	24.0	31.6	90.0	22.2	3.0	146.3
15. Maya-maya ***Lutjanus malabaricus***	Malabar red snapper	25.5	7.9	82.9	51.9	1.0	143.7
16. Tilapya ***Tilapya mossambica***	Tilapia	21.5	10.1	63.0	65.9	2.9	141.9
17. Dalagang bukid ***Caesio chrysozonus***	Golden caesio	25.4	10.0	107.1	21.5	1.2	139.8
18. Tulya ***Cyrenidae***	Clam	13.2	43.2	25.1	53.1	5.0	126.4
19. Talaba ***Ostrea sp.***	Oyster	7.8	39.9	20.7	63.8	0.4	124.8
20. Tahong ***Mytillus smaragdinus Chemnitz***	Salt-water mussel	14.5	40.8	35.0	41.6	2.6	120.0
21. Pusit ***Loligo pealli***	Squid	20.5	27.0	55.8	23.6	12.4	118.8
22. Dilat ***Ilishia hoeveni***	Big-eyed herring	21.0	9.5	77.4	27.5	2.1	116.5
23. Halaan ***Cyraeidae***	Clam	13.2	43.8	24.6	33.0	0.0	101.4
24. Tuwakang ***Stolephorus indicus***	Indian anchovy	19.4	8.7	49.1	40.6	0.0	98.4
25. Lapu-lapu ***Epinephelus corallicola***	Spotted grouper	20.7	4.3	51.8	23.4	7.1	86.6

Table 7. A typical one-day menu of Filipino adult

Breakfast	Lunch	Supper	Snack
Scrambled egg	Fried fish	Fish cooked in vinegar	Fried sweet potato in sugar (kamote kyu)
Boiled rice/pan de sal	Vegetables cooked in coconut milk	Sauteed monggo	Coffee with milk
Coffee with milk	Boiled rice	Boiled rice	
	Mango	Banana	

Table 8. Ingredient composition of a typical one-day menu of Filipino adult.

Food Item (Raw)	Amount (g)	Food Item	Amount (g)
Egg, chicken	7	Garlic	2
Oil	12	Onion	6
Salt	6	Tomatoes	24
Rice	320	Banana (latundan)	33
Bun (pan de sal)	27	Mango	27
Coffee	2	Mackerel (alumahan)	25
Milk, evaporated	9	Mungbean	10
Sweet potato	19	Shrimp	3
Sugar	20	Bitter melon tops (ampalaya)	13
Tuna (tulingan)	25	Pork, medium fat	20
Dried scad (galunggong)	3	Vinegar	5
Jackfruit (langka)	45	Fish sauce (patis)	1
Coconut milk (gata)	9	Fermented fish (bagoong)	2
Ginger	1		

The role of diet in hyperuricemia and gout was observed after the war when gouty arthritis become common after food supply normalized (8). The food supply obviously included a variety of purine sources to aggravate the cases. For treatment of gout, purine-free diets are generally not prescribed, but doctors usually recommend avoidance of excessive ingestion of purine-rich foods (8). Filipinos should be more observant of this dietary precaution owing to their less efficient system than Caucasians in excreting uric acid with the stress of a high purine diet (7,12).

Conclusions and Recommendation

The classification based on purine content of foods indicated that the following have high levels of purines; liver and spleen, small and large intestines of hog, liver and spleen of cattle and carabao, liver, intestine and gizzard of chicken and fishes like *alumahan, bangos, dilis, tamban, tanigi, bisugo, matang baka, tulingan* and *tunsoy*. Foods containing less amounts of purines are also included. It would be desirable to ascertain actual purine content of cooked dishes so that more accurate dietary recommendations can be made.

Since the purine analyses were carried out on uncooked samples, although reported in terms of cooked weights, the analytical data may be overestimated/underestimated for individual purines in actually cooked food samples, where cooking caused either extraction-resistant, binding or thermal destruction.

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References

1. Williams, R. *Nutrition and Diet Therapy* (The C. V. Mosby Co., Missouri, 1981).
2. Mitchell, R. A., Dibble, H. S., Hendenika, J. and Linnea, M. V. Gout. *Nutrition in Health and Disease* (J. B. Lippincott Co., New York, 1976).
3. Orten, J. M. and Neuhaus, O. W. *Human Biochemistry* (The C. V. Mosby Co., Missouri, 1982).
4. Young, L. L. *J. Fd. Sci. 45*, 1064 (1980).
5. Dorland. *Illustrated Medical Dictionary* (W. B. Saunders Co., Philadelphia and London, 1957).
6. Williams, R. *Basic Nutrition and Diet Therapy* (Mosby Yearbook, Missouri, 1992).
7. Flores, E. G., Cruz, A. J., Jardeliza, T. R., Mendoza, T. S. and Cilindro, P. A. *Phil. J. Nut. 35*, 194 (1982).
8. Hydrick, C. R. and Fox, I. H. *Nutrition Reviews' Present Knowledge in Nutrition* (Nut. Foundation Inc., Washington, D.C., 1984).
9. *Third National Nutrition Survey: Philippines 1987 (a) Food Consumption Survey* (FNRI, 1989).
10. Young, L. L. *J. Fd. Sci. 47*, 1374 (1982).
11. Clifford, A. J. and Story, D. L. *J. Nutr. 106*, 435 (1976).
12. Bayani-Sioson, P. S. and Healy, L. A. *Acta Med. Phil. 7*, 15 (1970).
13. Association of Official Analytical Chemists. *Official Methods of Analysis* (AOAC, Washington, D.C., 1980).
14. Young, L. L. *J. Fd. Sci. 48*, 315 (1983).
15. Hodgman, C. D. *Handbook of Chemistry and Physics* (Chemical Rubber Publishing Co., Ohio, 1945).
16. American Dietetic Association. *Handbook of Chemical Dietetics* (Yale University Press, London, 1981).
17. Personal Communication. Food Consumption Surveys Division (FNRI, 1990).