รายงานวิจัย

โครงการ : การศึกษาระดับวิตามินบี 12
ในซีรั่มผู้ป่วยที่ผ่าตัดทำกระเพาะปัสสาวะเทียม
SERUM VITAMIN B_{12} IN PATIENTS WITH
NEOBLADDER AFTER RADICAL CYSTECTOMY

ทุนวิจัยจาก : กองทุนพัฒนาคณะแพทยศาสตร์
มหาวิทยาลัยเชียงใหม่

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(ACKNOWLEDGEMENT)

คณะผู้วิจัยขอขอบคุณกองทุนพัฒนาคณะแพทยศาสตร์ มหาวิทยาลัยเชียงใหม่ ที่ได้สนับสนุนให้ทุนดำเนินการวิจัยนี้ให้สำเร็จลุล่วงตามวัตถุประสงค์

ขอขอบคุณ คุณจำนงค์ กิ่งแก้ว นักวิชาการสถิติ 6 สถาบันวิจัยวิทยาศาสตร์สุขภาพ มหาวิทยาลัยเชียงใหม่ ที่ให้ความอนุเคราะห์วิเคราะห์ข้อมูลผลการวิจัยทางสถิติ

ABSTRACT

Purpose : To compare serum levels of vitamin B_{12} , folic acid , ferritin and hematologic status in patients with two types of surgical techniques namely ileal conduit and Mainz pouch technique.

Methods : Hemoglobin , hematocrit , serum ferritin , serum vitamin B_{12} and serum folic acid were dwtermined in 16 patients with ileal conduit (IC) and 10 patients with Mainz pouch (MP) surgical technique. The post operation period was between 9 months and more than 10 years. Results of both types of surgery and post operation period were compared.

Results : The mean levels of serum vitamin B_{12} , folic acid , ferritin , hemoglobin and hematocrit in both groups were compared and found no statistical difference. Serum vitamin B_{12} below reference level was found 12.5 % in IC group and 10 % in MP group. Serum folic acid was within reference range in all patients. The mean levels of all chemical parameters of patients with post operation period less than 5 years and more than 5 years were compared. The difference between the two groups was not statistically significant.

Conclusion : Serum level of vitamin B_{12} , folic acid , ferritin and hematologic status in patients with bladder substitution by using terminal ileum should be monitored regularly.

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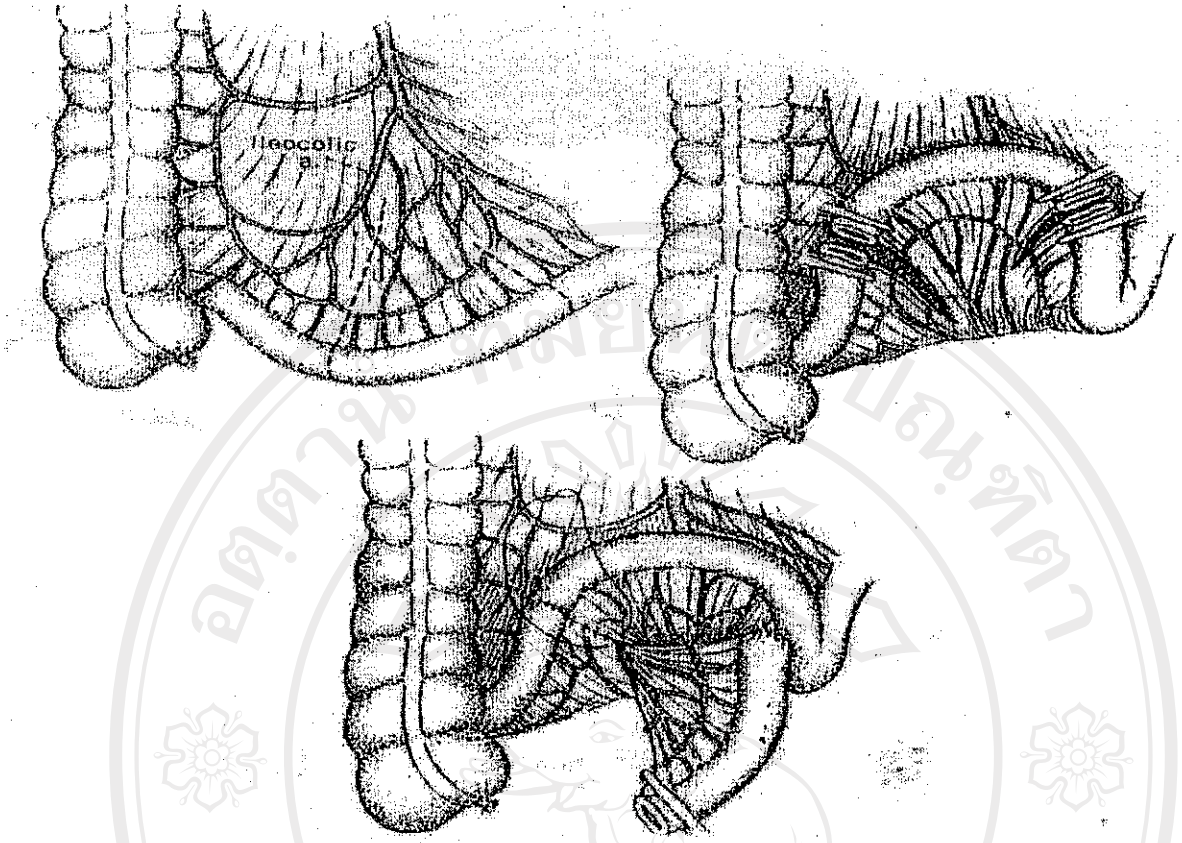
INTRODUCTION

The use of intestinal portion, particularty small intestine and length in technique of bladder substitution may alter the absorption process and can result in nutritional deficiencies. It is known that the ileum is the absorption area for vitamin B_{12}. Thus the removal of these segments have the potential to increase risk of vitamin B_{12} deficiency. Vitamin B_{12} is unable to synthesize in human and must obtain from animal product, which is the main dietary source. Free vitamin B_{12} must be released from dietary protein and bind to intrinsic factor in stomach. The vitamin B_{12}– intrinsic factor complex then proceeds to the ileum and attached to specific membrane receptor of the ileum and then is absorbed by phagocytosis (1). The purpose of this study is to assess the level of vitamin B_{12}, folic acid, ferritin and hematologic status in patients in whom part of the terminal ileum has been excluded for urological reconstruction.

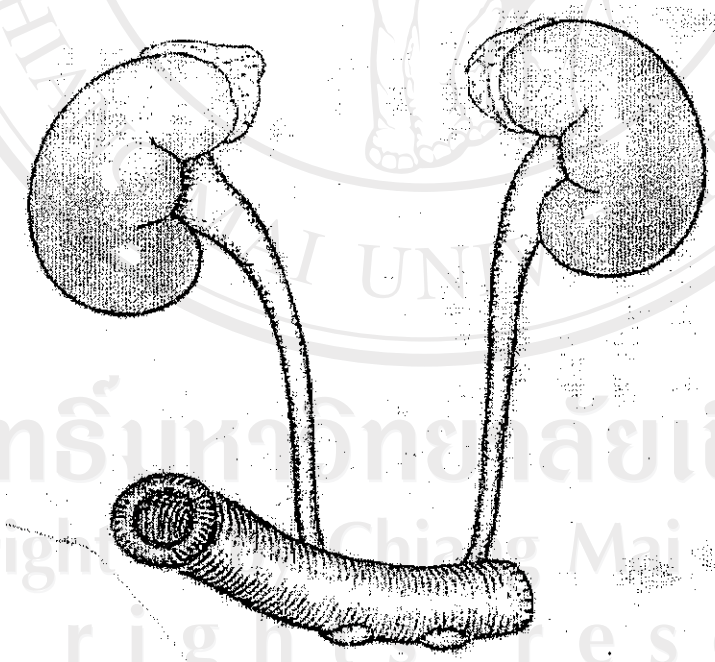
MATERIAL AND METHODS

A total of 26 patients with invasive bladder cancer who underwent bladder replacement at Maharaj Nakorn Chiangmai Hospital between 1983-1999 were recruited. The patient consisted of 22 men and 4 women with mean age of 61 years (range 37 to 83) and of post operation period was 59 months (range 9 to 179). Two different techniques of bladder substitution were used, 16 patients were operated with ileal conduit technique whereas 10 patients employed Mainz pouch technique.

Surgical technique : in case of ileal conduit replacement, we used 15 cms long of distal ileum away from ileocecal valve 10 cms, to create the incontinence diversion (Fig. I ; A, B) and Mainz pouch we used 20 - 30 cms long of terminal ileum and 15 cms in length of ascending colon including the ileocecal valve to create the neobladder (Fig. II ; A, B).

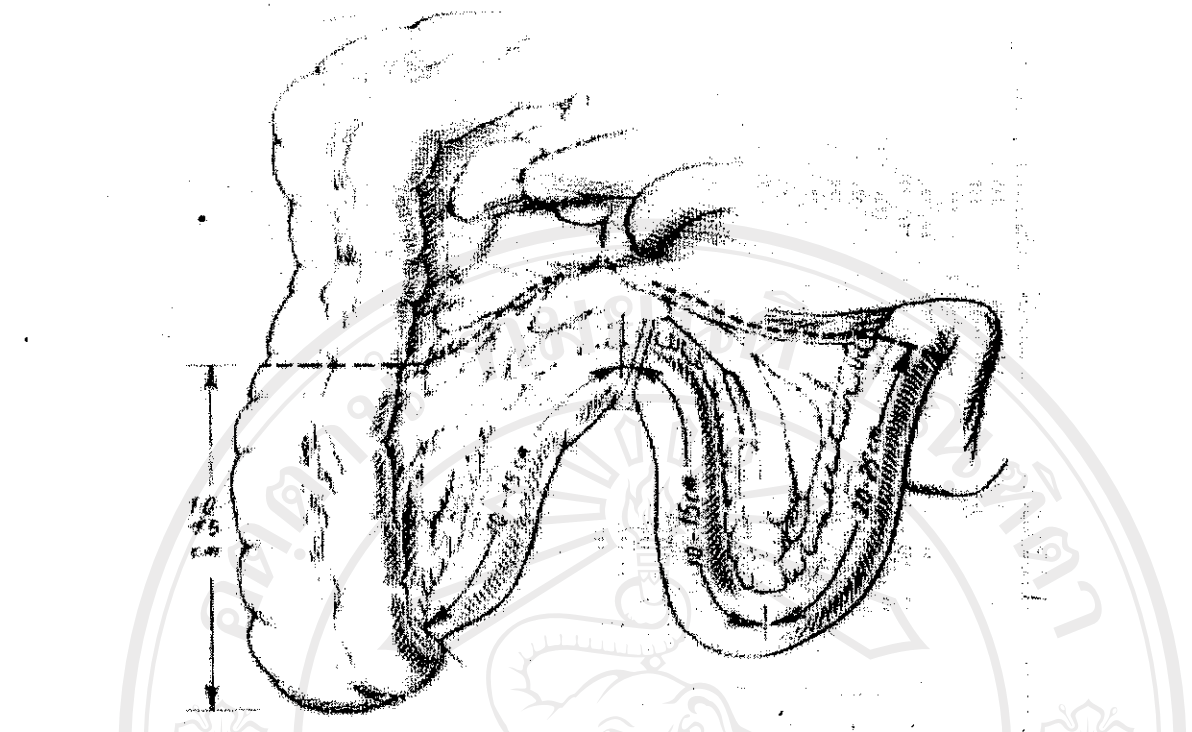


A

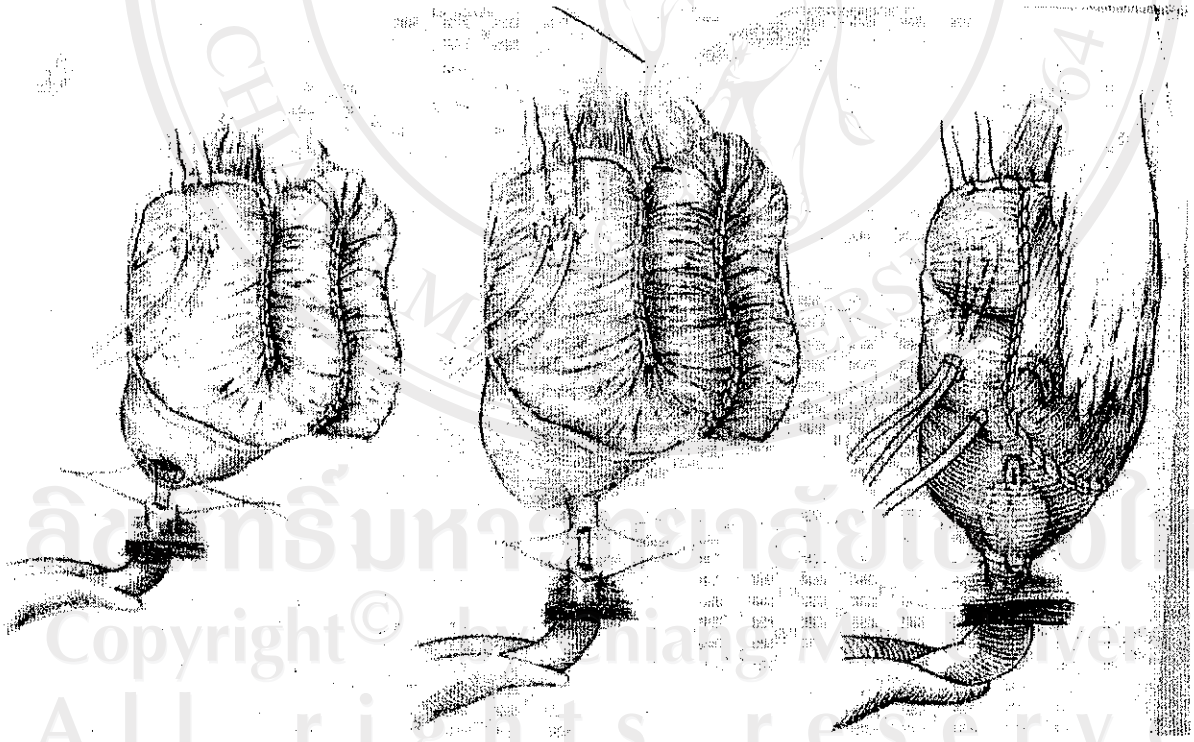


B

Fig. I ; A, B : Ileal conduit technique



A



B

Fig. II : A, B ; Mainz pouch technique

Chemical analysis

Eight ml. of venous blood sample was taken for measurement of hemoglobin concentration, hematocrit , serum ferritin, serum vitamin B_{12} and folic acid concentration. Hemoglobin was measured immediately on a specimen collected into EDTA – containing tubes by using an electronic counter fully automatic blood cell (Coulter Model STKS, Coulter Corporation, Miami, Florida, USA.). Hematocrit was measured by centrifuging a heparin – containing capillary tube at 2000 x g for 5 minutes at room temperature and comparing the height of the column of packed cells with the height of the entire column of red blood cell and plasma. The remaining of the blood sample was collected into the evacuated tube containing no anticoagulant. Within one hour, sample was centrifuged at 3,000 revolutions per minute for 10 minutes and serum was separated, divided into aliquots and stored at - 20^0 C prior to analysis. Serum ferritin was measured by an enzyme linked immuno sorbent assay (ELISA) employing horse – radish peroxidase as an enzyme lable and microtitre plate as solid phase (2). Serum vitamin B_{12} and folic acid concentration were determined using a simultaneous radioassay kit (Dual Count Solid Phase No Boil Assay, KDSP1, Diagnostic Products Corporation, Los Angeles, CA, USA.), using a gamma counter (D 501001 Model 5010 COBRA QUANTUM, Automatic Gamma Counter, Packard Instrument Company, CT USA.).

The method for vitamin B_{12} measurement was based on the competitive reaction between vitamin B_{12} in serum and a known amount of ^{57}Co vitamin B_{12} for binding to a limited amount of purified hog intrinsic factor. A bound and free form of vitamin B_{12} was separated and the radioactive count present in the bound form of each sample was determined. The principle of serum folic acid measurement was similar to those of vitamin B_{12}. Folic acid labeled with ^{125}I and folate binding protein was employed. Simultaneous assay of vitamin B_{12} and folic acid was accomplished with two isotopes, cobalt 57 (^{57}Co) and iodine 125 (^{125}I) which were easily separated by most dual channel gamma counters. (3)

A hemoglobin value below 12 g/dl and a hematocrit below 36 % were regarded as indications of iron deficiency anemia. Serum ferritin level of less than 20 ng /ml was considered as iron depletion(4). In addition , the reference range of serum vitamin B_{12} and serum folic acid were 200 - 950 pg /ml and 3.0 –17.0 ng/ml respectively (3). Comparison between two groups was done with student's t test. All data were presented as mean $\pm$ SD unless otherwise stated and $p < 0.05$ was considered significant.

RESULTS

Results of the post operative measurement with respect to hemoglobin, hematocrit, vitaminB_{12}, ferritin and folic acid in both groups were compared and found no significant different (Table 1). However we found out that in group of patients with ileal conduit, the serum level of vitamin B_{12} was below the normal value (< 200 pg/ml) in 2 out of 16 patients and in Mainz pouch group 1 out of 10 was abnormal. Concerning about serum level of ferritin there was only one from each group was below normal value and folic acid concentration was within normal range in all patients.

Depending on the time between operation and examination patients were divided into 2 groups ; I : less than 5 years post - operatively, II : more than 5 years. Both groups were compared and we found that there was no statistical difference (Table 2).

TABLE 1

Comparison of serum vitamin B12, folic acid, ferritin and hematologic status in patients with Ileal conduit and Mainz pouch surgical technique

	Ileal conduit (16)	**Mainz pouch** (10)	
	Mean ± SD	**Mean ± SD**	***p* value**
Age (year)	**61.2 ± 11.2**	**60.8 ± 8.6**	**0.91**
Hb (g %)	**12.41 ± 1.36**	**13.33 ± 1.63**	**0.13**
< 12	(5/16 = 31.3 %)	(2/10 = 20 %)	
Hct (%)	**37.8 ± 4.1**	**39.7 ± 5.06**	**0.29**
< 36	(3/16 = 18.8 %)	(2/10 = 20 %)	
Vit B_{12} (pg/ml)	**512.1 ± 268.5**	**515.0 ± 328.9**	**0.98**
< 200	(2/16 = 12.5 %)	(1/10 = 10 %)	
< 300	(3/16 = 18.8 %)	(3/10 = 30 %)	
Ferritin (ng/ml)	**164.9 ± 141.8**	**97.4 ± 45.8**	**0.16**
< 20	(1/16 = 6.3 %)	(1/10 = 10 %)	
Folic acid (ng/ml)	**9.0 ± 3.4**	**7.8 ± 5.9**	**0.51**
	none	none	

TABLE 2

Comparison of serum vitamin B_{12}, folic acid, ferritin and hematologic status in patients with follow up less than and greater than 5 years in both surgical technique

	Follow up < 5 years (15)	**Follow up > 5 years** (11)	**p value**
Hb (g /dl)	**12.44 ± 1.40**	**13.20 ± 1.61**	**0.21**
< 12	(4/15 = 26.7 %)	(3/11 = 27.3 %)	(1.0)
Hct (%)	**37.8 ± 4.2**	**39.5 ± 4.9**	**0.36**
< 36	(3/15 = 20 %)	(2/11 = 18.12 %)	(0.9)
Vit B_{12} (pg /ml)	**513.3 ± 244.8**	**513.1 ± 348.8)**	**1.0**
< 200	(1/15 = 6.7 %)	(2/11 = 18.2 %)	
< 300	(2/15 = 13.3 %)	(4/11 = 36.4 %)	
Ferritin (ng /ml)	**158.2 ± 145.2**	**112.6 ± 63.3**	**0.34**
< 20	(1/15 = 6.7 %)	(1/11 = 9.1 %)	
Folic acid (ng / ml)	**8.8 ± 3.7**	**8.1 ± 5.5**	**0.71**
	none	none	
Age (year)	**61.1 ± 11.1**	**61.1 ± 9.1**	**1.0**

DISCUSSION

Using bowel segment for construction of urinary tract are increasing nowadays, this result absorption of nutrient from the intestine. In previous study (5) it appeared that resection of 45 cms or more of ileum was likely to result in vitamin B_{12} or fat malabsorption. Malabsorption of bile acid may effect absorption of fat soluble vitamin A, D, E and K. There have been few report of severe complication (6). Matsui et al noted no evidence of malabsorption in 30 patients with an ileal neobladder (7). Because human are not able to synthesize vitamin B_{12} it must be ingested as food. It is absorbed in the terminal ileum with gastric intrinsic factor and for most part it is deposited in liver and bone marrow. Completed vitamin B_{12} deficiency may manifest after 3 to 6 years but partial vitamin malabsorption may become clinically evidence only as long as 30 years (8). Malabsorption can result in megaloblastic anemia, Hunter's glossitis and or a spinocerebellar degenerative disease. However vitamin B_{12} deficiency may also remain completely asymptomatic. In our 26 patients those with vitamin B_{12} serum level below normal are also asymptomatic.

The degree of disturbed absorption depend on the length of removal ileal segment. Some studies demonstrated that on resection more than 60 cms of terminal ileum cause malabsorption of bile acid and vitamin B_{12}. No disturbances were noted when less than 60 cms were resected (9,10). However in our studies 3 patients in both groups had decreased in serum level vitamin B_{12}, this may due to elderly patient which corresponding to the

report approximately 5 to 8 % of the elderly population had lower serum vitamin B_{12} (11,12). This corresponding to our study about 70 % of the patients were older than 60 years old. There is no controversy over whether this condition is due to age. Others define a value of less than 100 ng /ml as limit values but some recommend substitution when level are below 200 ng /ml (13). Folic acid can be absorbed by the entire small intestine (14), thus none of patients develops serum folic acid below normal range.

CONCLUSION

Serum level of Vit B_{12}, folic acid, ferritin and hematologic status in patients with bladder substitution by using terminal ileum should be monitored regularly. Malabsorption of vitamin B_{12} is related to the length of resected ileum. However in this study there is no statistically difference between the two procedure.

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ประสบการณ์การวิจัยและผลงานตีพิมพ์ที่เกี่ยวข้องกับสาขาที่จะทำการวิจัยครั้งนี้

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APPENDIX

1. PATIENTS INFORMATIONS AND RESULTS OF BLOOD ANALYSIS

1 : Patients Informations and Results of Blood Analysis

No	ชื่อ -สกุล	HN	Sex	Age	Date of	Post operation period		Type of	Date of	Hb	Hct	Vit B12	Ferritin	Folic acid
					Operation	Year	Month	diversion	investigation	(g/dl)	(%)	(pg/ml)	(ng/ml)	(ng/ml)
1	นายมานิตย์ พันธ์เกษม	1662597	ชาย	56	13/11/33	9	10	Ileal conduit	22/9/42	11.9	37.0	141.1	124.1	8.2
2	นายประกิจ วิศโกศา	1863264	ชาย	52	8/12/35	6	10	Mainz pouch	15/9/42	13.5	41.0	324.6	100	7.7
3	นายปรีดา จันทรังษี	687022	ชาย	68	21/2/41	1	7	Ileal Conduit	15/9/42	13.7	40.0	204.1	7.8	6.9
4	นายมนัส วิชิตตระกูลถาวร	1240161	ชาย	67	14/10/40	1	11	Ileal Conduit	13/9/42	13.1	38.3	459.8	132.5	9.2
5	นายจำปา นวมงาม	1996251	ชาย	65	11/8/37	5	1	Mainz pouch	15/9/42	12.6	38.6	485.1	108.6	3.8
6	นายสุวรรณ พรมแก้ว	1660817	ชาย	68		10	0	Mainz pouch	15/9/42	14.6	44.0	217.1	74.1	3.2
7	นายยืน ทาสิทธิ์	1850818	ชาย	57	2/2/36	6	7	Mainz pouch	15/9/42	14.3	43.0	684	110.6	6.7
8	นายเส็ง ปานธรรม	1844344	ชาย	64	20/7/35	7	2	Mainz pouch	6/10/42	13.3	38.0	583.9	155.6	7.1
9	นายวิเชียร เชื้อนธนันชัย	1495291	ชาย	42		7	2	Mainz pouch	22/9/42	15.5	46.0	192.6	16.6	3.9
10	จ.ส.อ. ตา หวลดี	1985423	ชาย	61	9/9/39	3	0	Ileal Conduit	22/9/42	11.5	35.3	437.1	186.1	5.3
11	นายปั่น อุเทียนยอง	1903033	ชาย	71	7/9/36	6	0	Mainz pouch	29/9/42	11.1	33.0	611.1	92	7
12	นายสวาท ล้ำทะประสิทธิ์	2273375	ชาย	61	11/8/41	1	1	Ileal Conduit	29/9/42	13.2	39.0	589.1	89.9	7.6
13	นายสีไลย์ ปวงละคร	2131399	ชาย	75	24/6/39	3	3	Ileal Conduit	6/10/42	13	39.0	404.1	103.3	11.7
14	นายเลื่อน ขีดดี	2237768	ชาย	59	20/1/41	1	8	Ileal Conduit	6/10/42	13.3	42.0	1137.6	183.3	7.4
15	นายส่ง พันตา	2265442	ชาย	49	9/6/41	1	4	Ileal Conduit	6/10/42	13.8	44.0	725.1	42.4	7.7

1 : Patients Informations and Results of Blood Analysis

No	ชื่อ -สกุล	HN	Sex	Age	Date of	operation period		Type of	Date of	Hb	Hct	Vit B12	Ferritin	Folic acid
					Operation	Year	Month	diversion	investigation	(g/dl)	(%)	(pg/ml)	(ng/ml)	(ng/ml)
16	นายจ่อม อินทรีย์	1833127	ชาย	59	29/9/35	7	2	Mainz pouch	22/9/42	14.4	43.8	475	33.4	5.1
17	นายคำ คำอุ่น	918895	ชาย	83	27/1/40	2	8	Ileal Conduit	29/9/42	13.5	40.0	336.9	102.5	7.8
18	นางวันนา สุริยะมณี	2171314	หญิง	54	28/10/40	1	11	Ileal Conduit	29/9/42	12.1	36.0	646.1	575.9	7
19	นายขัน ใจมุบ	2236197	ชาย	63	18/11/40	1	10	Ileal Conduit	22/9/42	12.3	35.6	149.3	41.8	6.1
20	นางวรรณดี ศรีดอกไม้	2154793	หญิง	52	15/10/39	2	11	Ileal Conduit	22/9/42	13.1	39.7	306.4	334.8	15.7
21	นายป้อ อินต๊ะมัด	1830178	ชาย	64	19/5/35	7	4	Mainz pouch	22/9/42	13.8	40	1312.9	148.7	9.7
22	นายปวง บุญจวง	1269053	ชาย	73	22/10/27	14	11	Ileal Conduit	22/9/42	12.6	38.6	837.5	249.4	7.3
23	นางสี คำลือ	2224057	หญิง	68	30/9/40	2	0	Ileal Conduit	29/9/42	8.2	25.0	681.1	282.2	13.6
24	นายแก้ว ไชยเสนา	1650435	ชาย	66	1/5/33	9	10	Mainz pouch	22/9/42	10.2	30.0	263.7	134.5	23.6
25	นางพรพิศ อ่ำแจ้ง	1983830	หญิง	37	3/10/38	4	0	Ileal Conduit	22/9/42	11.5	38.0	461.3	105.1	16.2
26	นายกำจัด ดวงจันทร์	2311013	ชาย	54	12/1/42	0	9	Ileal Conduit	6/10/42	11.7	37.0	676.4	77.1	6.4

2. DATA OF STATISTICAL ANALYSIS

2 : DATA OF STATISTICAL ANALYSIS

. Comparison by group

. ttest Age, by(treat)

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
1	16	61.25	2.805501	11.222	55.27022	67.22978
2	10	60.8	2.727636	8.625543	54.62966	66.97034
combined	26	61.07692	1.984496	10.11898	56.98978	65.16407
diff		.45	4.162193		-8.140345	9.040345

Degrees of freedom: 24

Ho: mean(1) - mean(2) = diff = 0

Ha: diff < 0	Ha: diff ~= 0	Ha: diff > 0
t = 0.1081	t = 0.1081	t = 0.1081
P < t = 0.5426	P > |t| = 0.9148	P > t = 0.4574

. ttest Hb, by(treat)

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
1	16	12.40625	.3402779	1.361112	11.68096	13.13154
2	10	13.33	.515978	1.631666	12.16278	14.49722
combined	26	12.76154	.2961329	1.509987	12.15164	13.37144
diff		-.9237501	.5919402		-2.145455	.2979544

Degrees of freedom: 24

Ho: mean(1) - mean(2) = diff = 0

Ha: diff < 0	Ha: diff ~= 0	Ha: diff > 0
t = -1.5605	t = -1.5605	t = -1.5605
P < t = 0.0659	P > |t| = 0.1317	P > t = 0.9341

. ttest Hct, by(treat)

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
1	16	37.78125	1.025964	4.103855	35.59446	39.96804
2	10	39.74	1.601125	5.063201	36.118	43.362
combined	26	38.53462	.8831402	4.503149	36.71575	40.35348
diff		-1.95875	1.809053		-5.692451	1.774951

Degrees of freedom: 24

Ho: mean(1) - mean(2) = diff = 0

Ha: diff < 0	Ha: diff ~= 0	Ha: diff > 0
t = -1.0827	t = -1.0827	t = -1.0827
P < t = 0.1448	P > |t| = 0.2897	P > t = 0.8552

. ttest Vit_B12, by(treat)

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]

1 | 16 512.0625 67.13438 268.5375 368.9689 655.156

2 | 10 515 104.0177 328.9329 279.6956 750.3045

---

combined | 26 513.1923 56.23455 286.7411 397.3751 629.0095

---

diff | -2.937513 117.971 -246.4177 240.5427

Degrees of freedom: 24

Ho: mean(1) - mean(2) = diff = 0

Ha: diff < 0 Ha: diff ~= 0 Ha: diff > 0

t = -0.0249 t = -0.0249 t = -0.0249

P < t = 0.4902 P > |t| = 0.9803 P > t = 0.5098

. ttest Folic_ac, by(treat)

Two-sample t test with equal variances

Group | Obs Mean Std. Err. Std. Dev. [95% Conf. Interval]

---

1 | 16 9.00625 .85066 3.40264 7.193111 10.81939

2 | 10 7.78 1.871589 5.918483 3.546172 12.01383

---

combined | 26 8.534615 .8754593 4.463984 6.731573 10.33766

---

diff | 1.22625 1.819459 -2.528929 4.98143

Degrees of freedom: 24

Ho: mean(1) - mean(2) = diff = 0

Ha: diff < 0 Ha: diff ~= 0 Ha: diff > 0

t = 0.6740 t = 0.6740 t = 0.6740

P < t = 0.7466 P > |t| = 0.5068 P > t = 0.2534

. ttest Ferritin, by(treat)

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
1	16	164.8875	35.45111	141.8044	89.32526	240.4497
2	10	97.41	14.49079	45.8239	64.62956	130.1904
combined	26	138.9346	23.15651	118.0755	91.24288	186.6263
diff		67.4775	46.5857		-28.67066	163.6257

Degrees of freedom: 24

Ho: mean(1) - mean(2) = diff = 0

Ha: diff < 0	Ha: diff ~= 0	Ha: diff > 0
t = 1.4485	t = 1.4485	t = 1.4485
P < t = 0.9198	P > |t| = 0.1604	P > t = 0.0802

. % Deficiency

. tab hbg Heamoglobin

hbg	Freq.	Percent	Cum.
1	7	26.92	26.92
2	19	73.08	100.00
Total	26	100.00	

. tab hctg Hematocrit

hctg	Freq.	Percent	Cum.
1	5	19.23	19.23
2	21	80.77	100.00
Total	26	100.00	

. tab b12g B12 <200

b12g	Freq.	Percent	Cum.
1	3	11.54	11.54
2	23	88.46	100.00
Total	26	100.00	

. tab b12g2 B12 <300

b12g2	Freq.	Percent	Cum.
1	6	23.08	23.08
2	20	76.92	100.00
Total	26	100.00	

. tab folicg Folic Acid

folicg	Freq.	Percent	Cum.
2	26	100.00	100.00
Total	26	100.00	

. tab ferg Ferritin

ferg	Freq.	Percent	Cum.
1	2	7.69	7.69
2	24	92.31	100.00
Total	26	100.00	

. Mean and SD by year of follow-up

. table time, c(mean Hb sd Hb)

time	mean(Hb)	sd(Hb)
1	12.44	1.401937
2	13.2	1.60686

1 = follow up < 5 yrs

2 = follow up > 5 yrs

. table time, c(mean Hct sd Hct)

time	mean(Hct)	sd(Hct)
1	37.83333	4.242416
2	39.49091	4.873901

. table time, c(mean Vit_B12 sd Vit_B12)

time	mean(Vit_B12)	sd(Vit_B12)

```
--------+--------------------
   1 |      513.3     244.7838
   2 |   513.0455     348.8041
--------+--------------------
```

```
. table time, c(mean  Ferritin sd  Ferritin)

--------+--------------------------
time | mean(Ferritin)   sd(Ferritin)
--------+--------------------------
   1 |       158.22     145.2394
   2 |   112.6364      63.27425
--------+--------------------------
```

```
. table time, c(mean  Folic_ac sd  Folic_ac)

---------+-------------------------
time | mean(Folic_ac)   sd(Folic_ac)
---------+-------------------------
   1 |   8.826667     3.748613
   2 |   8.136364     5.462833
---------+-------------------------
```

. ttest Hb,by(time)

1 = follow up < 5 yrs

2 = follow up > 5 yrs

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
1	15	12.44	.3619787	1.401938	11.66363	13.21637
2	11	13.2	.4844866	1.60686	12.1205	14.2795
combined	26	12.76154	.2961329	1.509987	12.15164	13.37144
diff		-.76	.5917651		-1.981343	.4613431

Degrees of freedom: 24

Ho: mean(1) - mean(2) = diff = 0

Ha: diff < 0	Ha: diff ~= 0	Ha: diff > 0
t = -1.2843	t = -1.2843	t = -1.2843
P < t = 0.1056	P > |t| = 0.2113	P > t = 0.8944

. ttest Hct,by(time)

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
1	15	37.83333	1.095387	4.242416	35.48396	40.1827
2	11	39.49091	1.469536	4.873901	36.21658	42.76524
combined	26	38.53462	.8831402	4.503149	36.71575	40.35348
diff		-1.657576	1.792773		-5.357678	2.042526

Degrees of freedom: 24

Ho: mean(1) - mean(2) = diff = 0

Ha: diff < 0	Ha: diff ~= 0	Ha: diff > 0
t = -0.9246	t = -0.9246	t = -0.9246
P < t = 0.1822	P > |t| = 0.3644	P > t = 0.8178

. ttest Vit_B12,by(time)

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
1	15	513.3	63.2029	244.7838	377.7433	648.8567
2	11	513.0455	105.1684	348.8041	278.7156	747.3753
combined	26	513.1923	56.23455	286.7411	397.3751	629.0095
diff		.2545328	116.1713		-239.5113	240.0204

Degrees of freedom: 24

Ho: mean(1) - mean(2) = diff = 0

Ha: diff < 0	Ha: diff ~= 0	Ha: diff > 0
t = 0.0022	t = 0.0022	t = 0.0022
P < t = 0.5009	P > |t| = 0.9983	P > t = 0.4991

. ttest Ferritin,by(time)

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
1	15	158.22	37.50066	145.2394	77.78909	238.6509
2	11	112.6364	19.0779	63.27425	70.12815	155.1446

```
--------+--------------------------------------------------------------------
combined |    26   138.9346   23.15651   118.0755   91.24288   186.6263
--------+--------------------------------------------------------------------
    diff |          45.58364   46.92391            -51.26255   142.4298
------------------------------------------------------------------------------
Degrees of freedom: 24

                 Ho: mean(1) - mean(2) = diff = 0

     Ha: diff < 0                 Ha: diff ~= 0                 Ha: diff > 0
      t =  0.9714                  t =  0.9714                  t =  0.9714
  P < t =  0.8295              P > |t| =  0.3410              P > t =  0.1705

. ttest   Folic_ac,by(time)

Two-sample t test with equal variances

------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       1 |      15    8.826667    .9678876    3.748613    6.750754    10.90258
       2 |      11    8.136364    1.647106    5.462833    4.466382    11.80634
---------+--------------------------------------------------------------------
combined |      26    8.534615    .8754593    4.463984    6.731573    10.33766
---------+--------------------------------------------------------------------
    diff |            .6903031    1.803058               -3.031025    4.411631
------------------------------------------------------------------------------
Degrees of freedom: 24

                 Ho: mean(1) - mean(2) = diff = 0

     Ha: diff < 0                 Ha: diff ~= 0                 Ha: diff > 0
      t =  0.3829                  t =  0.3829                  t =  0.3829
  P < t =  0.6474              P > |t| =  0.7052              P > t =  0.3526
```

. ttest Age,by(time)

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
1	15	61.06667	2.875954	11.13852	54.89836	67.23497
2	11	61.09091	2.73514	9.071434	54.99664	67.18518
combined	26	61.07692	1.984496	10.11898	56.98978	65.16407
diff		-.0242424	4.09964		-8.485483	8.436998

Degrees of freedom: 24

Ho: mean(1) - mean(2) = diff = 0

Ha: diff < 0	Ha: diff ~= 0	Ha: diff > 0
t = -0.0059	t = -0.0059	t = -0.0059
P < t = 0.4977	P > |t| = 0.9953	P > t = 0.5023

. tab treat hbg, ro co ch

treat	hbg 1	2	Total
1	5	11	16
	31.25	68.75	100.00
	71.43	57.89	61.54
2	2	8	10
	20.00	80.00	100.00
	28.57	42.11	38.46

X axis 1 = IC
2 = MP

Y axis 1 = deficiency
2 = normal

```
----------+----------------------+----------
    Total |       7        19 |       26
          |   26.92     73.08 |   100.00
          |  100.00    100.00 |   100.00

      Pearson chi2(1) =   0.3959   Pr = 0.529
```

. tab treat hctg, ro co ch

```
          |      hctg
    treat |       1        2 |    Total
----------+----------------------+----------
        1 |       3       13 |       16
          |   18.75     81.25 |   100.00
          |   60.00     61.90 |    61.54
----------+----------------------+----------
        2 |       2        8 |       10
          |   20.00     80.00 |   100.00
          |   40.00     38.10 |    38.46
----------+----------------------+----------
    Total |       5       21 |       26
          |   19.23     80.77 |   100.00
          |  100.00    100.00 |   100.00

      Pearson chi2(1) =   0.0062   Pr = 0.937
```

. tab treat b12g, ro co ch

```
          |      b12g
    treat |       1        2 |    Total
----------+----------------------+----------
        1 |       2       14 |       16
          |   12.50     87.50 |   100.00
          |   66.67     60.87 |    61.54
----------+----------------------+----------
        2 |       1        9 |       10
          |   10.00     90.00 |   100.00
          |   33.33     39.13 |    38.46
```

```
----------+----------------------+----------
    Total |        3        23 |       26
          |    11.54     88.46 |   100.00
          |   100.00    100.00 |   100.00

          Pearson chi2(1) =   0.0377   Pr = 0.846
```

```
. tab treat   b12g2, ro co ch

          |      b12g2
    treat |        1         2 |    Total
----------+----------------------+----------
        1 |        3        13 |       16
          |    18.75     81.25 |   100.00
          |    50.00     65.00 |    61.54
----------+----------------------+----------
        2 |        3         7 |       10
          |    30.00     70.00 |   100.00
          |    50.00     35.00 |    38.46
----------+----------------------+----------
    Total |        6        20 |       26
          |    23.08     76.92 |   100.00
          |   100.00    100.00 |   100.00

          Pearson chi2(1) =   0.4388   Pr = 0.508
```

```
. tab treat   folicg, ro co ch

          |    folicg
    treat |         2 |    Total
----------+-----------+----------
        1 |        16 |       16
          |    100.00 |   100.00
          |     61.54 |    61.54
----------+-----------+----------
        2 |        10 |       10
          |    100.00 |   100.00
          |     38.46 |    38.46
```

```
----------+----------+---------
    Total |       26 |       26
          |   100.00 |   100.00
----------+----------+---------
          |   100.00 |   100.00
```

. tab treat ferg, ro co ch

```
          |      ferg
    treat |         1         2 |     Total
----------+----------------------+---------
        1 |         1        15 |        16
          |      6.25     93.75 |    100.00
          |     50.00     62.50 |     61.54
----------+----------------------+---------
        2 |         1         9 |        10
          |     10.00     90.00 |    100.00
          |     50.00     37.50 |     38.46
----------+----------------------+---------
    Total |         2        24 |        26
          |      7.69     92.31 |    100.00
          |    100.00    100.00 |    100.00

          Pearson chi2(1) =   0.1219   Pr = 0.727
```

. tab hbg time, ch cell

```
          |      time
      hbg |         1         2 |     Total
----------+----------------------+---------
        1 |         4         3 |         7
          |     15.38     11.54 |     26.92
----------+----------------------+---------
        2 |        11         8 |        19
          |     42.31     30.77 |     73.08
----------+----------------------+---------
```

X axis 1 = follow up < 5 yrs

2 = follow up > 5 yrs

Y axis 1 = deficiency

2 = normal

Total	15	11	26
	57.69	42.31	100.00

Pearson chi2(1) = 0.0012 Pr = 0.973

. tab hctg time, ch cell

hctg \ time	1	2	Total
1	3	2	5
	11.54	7.69	19.23
2	12	9	21
	46.15	34.62	80.77
Total	15	11	26
	57.69	42.31	100.00

Pearson chi2(1) = 0.0135 Pr = 0.907

. tab b12g time, ch cell

b12g \ time	1	2	Total
1	1	2	3
	3.85	7.69	11.54
2	14	9	23
	53.85	34.62	88.46
Total	15	11	26
	57.69	42.31	100.00

Pearson chi2(1) = 0.8244 Pr = 0.364

. tab b12g2 time, ch cell

time		
b12g2	1	2	Total
1	2	4	6
	7.69	15.38	23.08
2	13	7	20
	50.00	26.92	76.92
Total	15	11	26
	57.69	42.31	100.00

Pearson chi2(1) = 1.8962 Pr = 0.169

. tab folicg time, ch cell

time		
folicg	1	2	Total
2	15	11	26
	57.69	42.31	100.00
Total	15	11	26
	57.69	42.31	100.00

. tab ferg time, ch cell

time		
ferg	1	2	Total
1	1	1	2
	3.85	3.85	7.69
2	14	10	24

	53.85	38.46	92.31
Total	15	11	26
	57.69	42.31	100.00

Pearson chi2(1) = 0.0525 Pr = 0.819

3. DATA OF VITAMIN B_{12} AND SERUM FOLIC ACID MEASUREMENT

Count Time(minutes): 1.00
Assay Type: DUAL RIA %REF.
Background Subtract : IPA Bkg
Outlier: 5.0 FLAG
%Spillup: 0.00
%Spilldown: 0.00
REPROCESSED VIA EDITDATA

	Window A	Window B
Nuclide:	Co-57	I-125
Half Life(hours):	0.00	0.00
Count Fraction:	BOUND	BOUND
Multiplier:	1.0000	1.0000
Normal Range:	200.0 - 950.0 pg/ml	3.000 - 17.00 ng/ml
%CV Flag Limit:	0.00	0.00
Curve Fit:	LOGIT	LOGIT
X Transform:	LOG	LOG
Y Transform:	LOGIT	LOGIT

WARNING: Previous curve A not stored to template

WARNING: Previous curve B not stored to template

S#	A:CPM	A:%ERR	B:CPM	B:%ERR	A:ERROR	A:%B(F)	A:%CV	A:DOSE	B:ERROR	B:%CV	B:DOSE	B:%B(F)	PAT/ID
1	18629.0		41525.0										
2 MISSING TUBE(S)													
	18629.0	0.73	41525.0	0.49									TOTAL
4	45.5		99.0										
1 MISSING TUBE(S)													
	45.5	14.8	99.0	10.1									BLANK
1 MISSING TUBE(S)													
7	9455.0		17161.0					0.0000			0.0000		
	9455.0	1.03	17161.0	0.76		100.0		0.0000			0.0000	100.0	STD 1
8	8481.0		13797.0			89.65		50.000			.50000	80.28	
9	8604.0		14116.0			90.96		50.000			.50000	82.15	
	8542.5	1.02	13956.5	1.62		90.30		50.000			.50000	81.22	STD 2
10	7837.0		12819.0			82.80		100.00			1.0000	74.55	
11	7877.0		13131.0			83.23		100.00			1.0000	76.38	
	7857.0	0.80	12975.0	1.70		83.02		100.00			1.0000	75.47	STD 3
12	5756.0		8593.0			60.69		300.00			3.0000	49.78	
13	6179.0		9325.0			65.18		300.00			3.0000	54.07	
	5967.5	5.01	8959.0	5.78		62.94		300.00			3.0000	51.93	STD 4
14	4419.0		6082.0			46.48		600.00			6.0000	35.07	
15	4540.0		6268.0			47.77		600.00			6.0000	36.16	
	4479.5	1.91	6175.0	2.13		47.12		600.00			6.0000	35.61	STD 5

Protocol #: 1 Vit B12 Folate User : Sukanya

S#	A:CPM	A:%ERR	B:CPM	B:%ERR	A:ERROR	A:%B(F)	A:%CV	A:DOSE	B:ERROR	B:%CV	B:DOSE	B:%B(F)	PAT/ID
16	3141.0		3928.0			32.90		1200.0			12.000	22.44	
17	3016.0		3966.0			31.57		1200.0			12.000	22.66	
	3078.5	2.87	3947.0	1.13		32.23		1200.0			12.000	22.55	STD 6
18	2013.0		2544.0			20.91		2400.0			24.000	14.33	
19	2019.0		2660.0			20.97		2400.0			24.000	15.01	
	2016.0	1.57	2602.0	3.15		20.94		2400.0			24.000	14.67	STD 7

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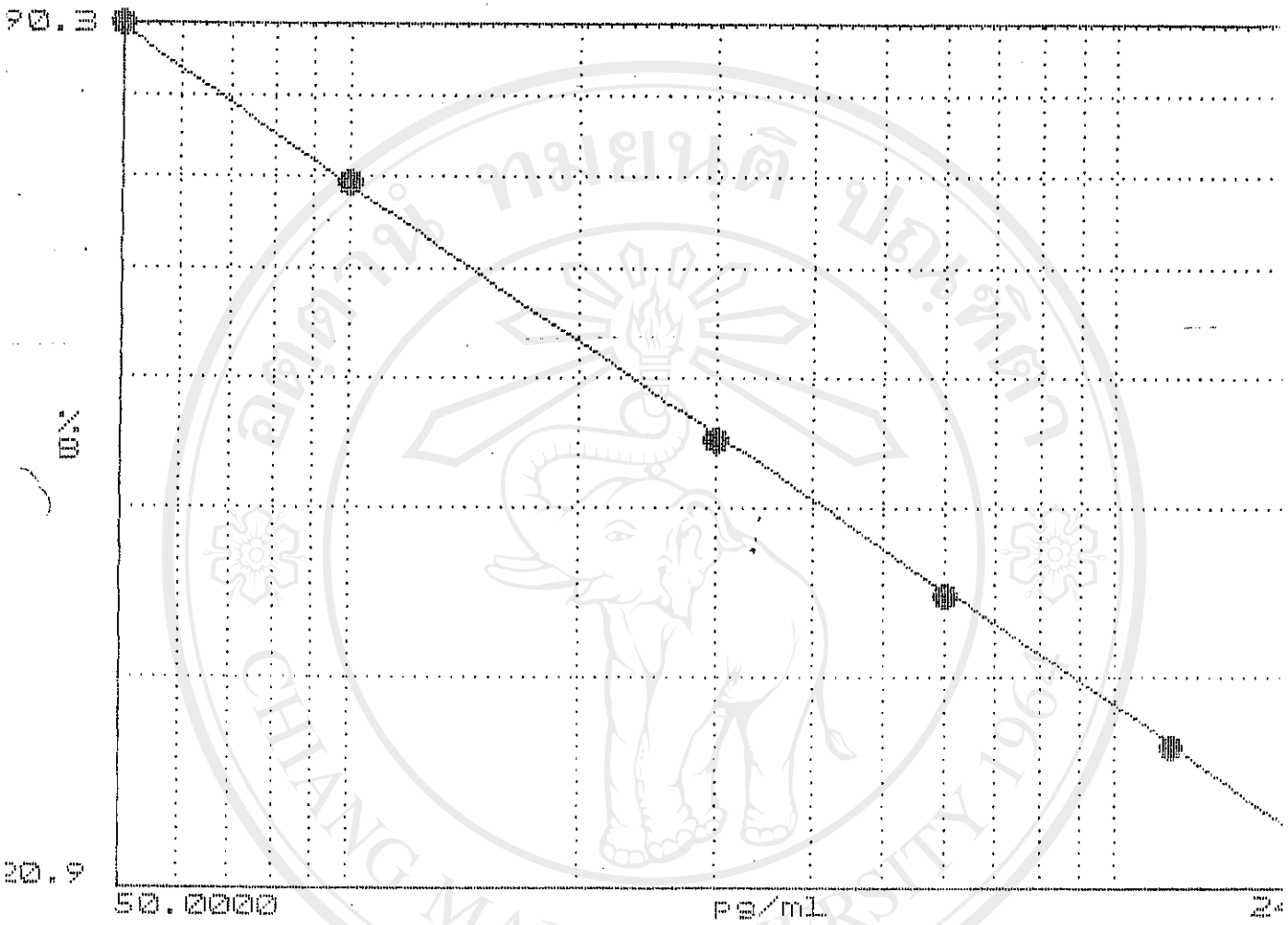
Protocol #: 1 Vit B12 Folate User : Sukanya

Assay Type: DUAL RIA %REF. BOUND Label : A Serum Vit



STD #	CPM	DEFINED DOSE	%B/F	CALC.DOSE	% DIFF
2	8543	50.00000	90.30	49.13117	-1.74
3	7857	100.00000	83.02	98.53818	-1.46
4	5968	300.00000	62.94	308.68482	2.89
5	4480	600.00000	47.12	619.28768	3.21
6	3079	1200.0000	32.23	1219.9939	1.67
7	2016	2400.0000	20.94	2295.6624	-4.35

Curve Fit : LOGIT Transform X : LOG Transform Y : LOGIT

Corr.Coef. : 0.9998 Slope : -2.1321

Det.Limit : 50.0000 Para.Coef. : .9997

%NSB/Total : 0.2442 %Ref/Total : 50.510

ED20 : OFF CURVE ED50 : 546.83 ED80 : 122.37

%Sigma Std. : 2.5923

Intercept : 5.83750

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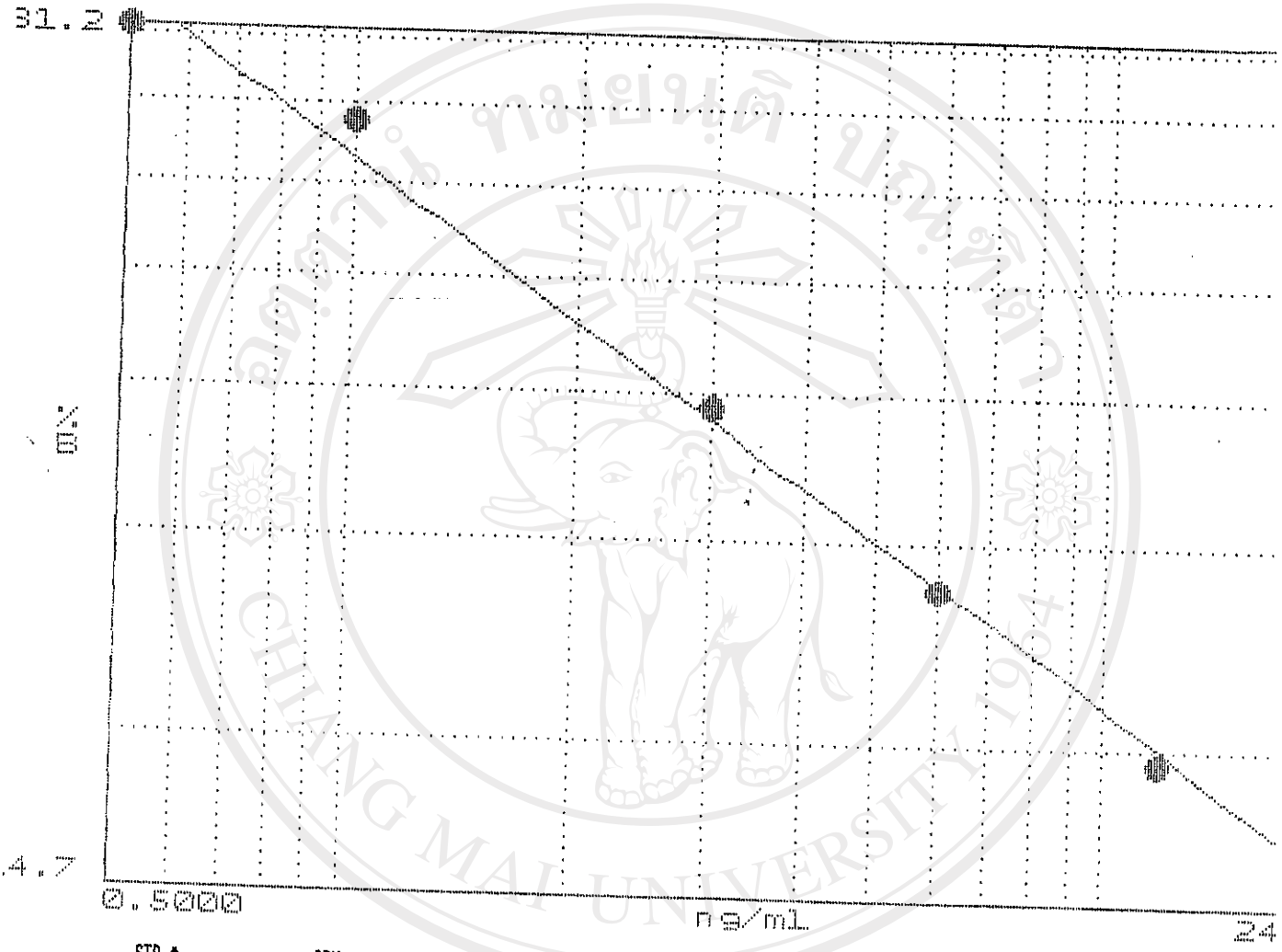
Protocol #: 1 — Vit B12 Folate — User : Sukanya

WARNING: CURRENT CURVE FAILS TEMPLATE CRITERIA

Assay Type: DUAL RIA %REF. BOUND

Label : B Serum



STD #	CPM	DEFINED DOSE	%B/F	CALC.DOSE	% DIFF
2	13957	0.50000	81.22	0.57532	15.06
3	12975	1.00000	75.47	0.85164	-14.84
4	8959	3.00000	51.93	2.84143	-5.29
5	6175	6.00000	35.61	6.14179	2.36
6	3947	12.00000	22.55	12.85445	7.12
7	2602	24.00000	14.67	23.58194	-1.74

Curve Fit : LOGIT
Corr.Coef. : 0.9975
Det.Limit : 0.5000
%NSB/Total : 0.2384
ED20 : 15.323
%Sigma Std. : 3.7803
Intercept : .984147

Transform X : LOG

ED50 : 3.1055

Transform Y : LOGIT
Slope : -1.9998
Para.Coef. : .9694
%Ref/Total : 41.089
ED80 : 0.6294

Protocol #: 1 Vit B12 Folate $\bar{x}$ = 155 range 127–183 pg/ml User : Sukanya

Vit B
Folic
Anemia c OK.

S#	A:CPM	A:%ERR	B:CPM	B:%ERR	A:ERROR	A:%B(F)	A:%CV	A:DOSE	B:ERROR	B:%CV	B:DOSE	B:%B(F)	PAT/ID	
20	7258.0		11634.0			76.65		151.47			1.3311	67.61		
21	6996.0		10855.0			73.87		178.04			1.6793	63.04		
	7127.0	2.60	11244.5	4.90		75.26	11.40	164.47		16.35	1.4978	65.32	Anemia c	
22	7245.0		5090.0		Range: Lo	76.51		152.74			8.5853	29.25		
23	7488.0		5374.0		Range: Lo	79.10		129.94			7.8375	30.92		
	7366.5	2.33	5232.0	3.84	Range: Lo	77.80	11.41	141.11		6.440	8.2000	30.08	SAMPLE	1
24	5914.0		5466.0			62.37		316.89			7.6140	31.46		
25	5816.0		5427.0			61.33		332.36			7.7077	31.23		
	5865.0	1.18	5446.5	0.96		61.85	3.370	324.56		.8648	7.6607	31.34	SAMPLE	2
26	6815.0		5729.0		Range: Lo	71.94		197.79			7.0197	33.00		
27	6704.0		5805.0			70.76		210.51			6.8593	33.44		
	6759.5	1.16	5767.0	0.93		71.35	4.406	204.09		1.635	6.9389	33.22	SAMPLE	3
28	5230.0		4908.0			55.10		438.40			9.1163	28.19		
29	5024.0		4863.0			52.91		482.18			9.2545	27.92		
	5127.0	2.84	4885.5	1.01		54.00	6.726	459.81		1.064	9.1850	28.05	SAMPLE	4
30	4871.0		7767.0			51.28		517.33			3.9232	44.94		
31	5151.0		7996.0			54.26		454.73			3.6863	46.28		
	5011.0	3.95	7881.5	2.05		52.77	9.108	485.08		4.404	3.8028	45.61	SAMPLE	5
32	6763.0		8822.0			71.39		203.69	Range: Lo		2.9486	51.13		
33	6534.0		8223.0			68.96		230.96			3.4664	47.61		
	6648.5	2.44	8522.5	4.97		70.17	8.871	217.06		11.41	3.1969	49.37	SAMPLE	6
34	4498.0		6124.0			47.32		614.03			6.2349	35.31		
35	4031.0		5649.0			42.36		762.76			7.1938	32.53		
	4264.5	7.74	5886.5	5.71		44.84	15.28	683.98		10.10	6.6924	33.92	SAMPLE	7
36	4620.0		5727.0			48.62		580.53			7.0240	32.99		
37	4595.0		5700.0			48.35		587.24			7.0822	32.83		
	4607.5	1.04	5713.5	0.94		48.48	.8123	583.88		.5836	7.0530	32.91	SAMPLE	8
38	6780.0		7719.0			71.57		201.75			3.9750	44.66		
39	6944.0		7908.0		Range: Lo	73.31		183.59			3.7755	45.77		
	6862.0	1.69	7813.5	1.71	Range: Lo	72.44	6.664	192.55		3.640	3.8738	45.21	SAMPLE	9
40	5173.0		6414.0			54.49		450.13			5.7280	37.01		
41	5300.0		6953.0			55.84		424.37			4.9127	40.17		
	5236.5	1.71	6683.5	5.70		55.17	4.166	437.08		10.84	5.3016	38.59	SAMPLE	10
42	4521.0		5777.0			47.56		607.57			6.9178	33.28		
43	4496.0		5700.0			47.30		614.60			7.0822	32.83		
	4508.5	1.05	5738.5	0.95		47.43	.8137	611.07		1.660	6.9994	33.05	SAMPLE	11
44	4675.0		5551.0			49.20		566.05			7.4150	31.95		
45	4501.0		5398.0			47.35		613.19			7.7784	31.06		
	4588.0	2.68	5474.5	1.98		48.28	5.653	589.13		3.383	7.5938	31.51	SAMPLE	12

Protocol #: 1 Vit B12 Folate User : Sukanya

S#	A:CPM	A:%ERR	B:CPM	B:%ERR	A:ERROR	A:%B(F)	A:%CV	A:DOSE	B:ERROR	B:%CV	B:DOSE	B:%B(F)	PAT/ID	
46	5315.0		4156.0			56.00		421.41			11.875	23.78		
47	5495.0		4234.0			57.91		387.35			11.537	24.24		
	5405.0	2.35	4195.0	1.31		56.96	5.956	404.07		2.040	11.704	24.01	SAMPLE	13
48	3140.0		5439.0		Range: Hi	32.89		1181.4			7.6787	31.30		
49	3286.0		5684.0		Range: Hi	34.44		1096.0			7.1170	32.73		
	3213.0	3.21	5561.5	3.12	Range: Hi	33.66	5.304	1137.6		5.369	7.3908	32.02	SAMPLE	14
50	4237.0		5424.0			44.55		692.77			7.7150	31.21		
51	4041.0		5402.0			42.46		759.18			7.7686	31.08		
	4139.0	3.35	5413.0	0.96		43.50	6.468	725.13		.4895	7.7417	31.15	SAMPLE	15
52	5159.0		6874.0			54.34		453.05			5.0231	39.71		
53	4954.0		6720.0			52.17		497.97			5.2468	38.81		
	5056.5	2.87	6797.0	1.60		53.25	6.679	475.01		3.081	5.1335	39.26	SAMPLE	16
54	5831.0		5399.0			61.49		329.96			7.7759	31.06		
55	5745.0		5350.0			60.57		343.94			7.8972	30.78		
	5788.0	1.05	5374.5	0.96		61.03	2.934	336.89		1.095	7.8363	30.92	SAMPLE	17
56	4322.0		5613.0			45.45		666.00			7.2741	32.32		
57	4453.0		5826.0			46.84		626.90			6.8158	33.57		
	4387.5	2.11	5719.5	2.63		46.14	4.277	646.13		4.600	7.0401	32.94	SAMPLE	18
58	7395.0		6230.0		Range: Lo	78.11		138.45			6.0434	35.93		
59	7166.0		6175.0		Range: Lo	75.67		160.54			6.1418	35.61		
	7280.5	2.22	6202.5	0.80	Range: Lo	76.89	10.45	149.29		1.142	6.0923	35.77	SAMPLE	19
60	6033.0		3558.0			63.63		298.86			15.026	20.27		
61	5932.0		3348.0			62.56		314.11			16.437	19.04		
	5982.5	1.19	3453.0	4.30		63.10	3.520	306.41		6.342	15.708	19.66	SAMPLE	20
62	2888.0		4624.0		Range: Hi	30.21		1350.8			10.040	26.52		
63	2993.0		4809.0		Range: Hi	31.32		1276.5			9.4242	27.61		
	2940.5	2.52	4716.5	2.77	Range: Hi	30.77	4.000	1312.9		4.471	9.7250	27.06	SAMPLE	21
64	3704.0		5476.0			38.88		891.24			7.5902	31.51		
65	3963.0		5701.0			41.63		787.59			7.0800	32.83		
	3833.5	4.78	5588.5	2.85		40.26	8.731	837.53		4.919	7.3293	32.17	SAMPLE	22
66	4099.0		3803.0			43.08		738.81			13.600	21.71		
67	4448.0		3802.0			46.79		628.34			13.606	21.70		
	4273.5	5.77	3802.5	1.15		44.93	11.43	681.13		.0281	13.603	21.71	SAMPLE	23
68	6209.0		2586.0			65.50		273.60	Range: Hi		23.787	14.58		
69	6354.0		2620.0			67.04		253.96	Range: Hi		23.355	14.78		
	6281.5	1.63	2603.0	1.39		66.27	5.263	263.65	Range: Hi	1.296	23.569	14.68	SAMPLE	24
70	5034.0		3389.0			53.02		479.96			16.146	19.28		
71	5206.0		3386.0			54.84		443.30			16.167	19.27		
	5120.0	2.38	3387.5	1.21		53.93	5.616	461.30		.0920	16.157	19.27	SAMPLE	25

S#	A:CPM	A:%ERR	B:CPM	B:%ERR	A:ERROR	A:%B(F)	A:%CV	A:DOSE	B:ERROR	B:%CV	B:DOSE	B:%B(F)	PAT/ID	
72	4340.0		6013.0			45.64		660.47			6.4436	34.66		
73	4287.0		6109.0			46.55		692.77			6.2526	35.22		
	4313.5	1.70	6061.0	1.12		46.09	3.376	676.61		2.015	6.3523	34.94	SAMPLE	26
74	5250.0		6072.0			55.31		434.35			6.3316	35.01		
75	5180.0		6025.0			54.57		448.67			6.4206	34.73		
	5215.0	0.98	6048.5	0.91		54.94	2.295	441.46		.9875	6.3759	34.87	SAMPLE	27
76	7019.0		5976.0		Range: Lo	74.11		175.62			6.5151	34.44		
77	6911.0		5720.0		Range: Lo	72.96		187.17			7.0390	32.94		
	6965.0	1.10	5848.0	3.10	Range: Lo	73.54	4.503	181.34		5.466	6.7705	33.89	SAMPLE	28

Anemia Control

Use According to Package Insert

Lot Number: 020B
Expiration Date: JAN 31 01

One vial of a lyophilized protein-based control with *lot-specific* vitamin B12 and folic acid concentrations in the deficient range. Reconstitute with **2.0 mL** distilled water. Store refrigerated: stable at 2–8°C for 7 days. For longer storage, aliquot and freeze: stable at –20°C for 2 months. Avoid excessive exposure to direct light.

The tabulated values were generated with DPC's Solid Phase No Boil Dualcount and Dualcount Solid Phase Boil kits. They should be considered *as guidelines only*. Each laboratory should develop its own expected values and range limits as part of an ongoing quality control program.

Vitamin B12

Kit	Mean	SD	2SD Range	Units
SP No Boil	155	14	127 – 183	pg/mL
SP Boil	137	16	105 – 169	
SP No Boil	114	10	94 – 134	pmol/L
SP Boil	101	12	77 – 125	

Folic Acid

Kit	Mean	SD	2SD Range	Units
SP No Boil	1.63	0.13	1.37 – 1.89	ng/mL
SP Boil	1.42	0.14	1.14 – 1.70	
SP No Boil	3.69	0.30	3.09 – 4.29	nmol/L
SP Boil	3.22	0.32	2.58 – 3.86	

Safety Matters: Like all human body fluid-derived material, this control should be handled as if capable of transmitting hepatitis or AIDS. Sodium azide has been added as a preservative; on disposal, flush with large volumes of water to prevent the buildup of explosive metal azides in plumbing.

Technical Assistance:
Tel: 800.372.1782
Tel: 310.645.8200
Fax: 310.645.9999

Catalog Number:
ANC

DPC®
Diagnostic Products Corporation
5700 West 96th Street
Los Angeles, CA 90045-5597

August 13, 1999
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