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'VITAMIN INTAKE OF THE ELDERLY (60-80YEARS) AND ITS CORRELATES WITH SOCIO-DEMOGRAPHIC PROFILE AND DIETARY PATTERN'

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Abstract
The present investigation was undertaken to assess the vitamin intake of the elderly (60-80 years) from Central India. 200 males and 200 females were selected from Nagpur city, Maharashtra, India. All the subjects were personally interviewed and their socio-demographic characteristics, general dietary practices were studied by specially formulated questionnaire. The quantitative daily food intake was assessed by 24 hours recall method of diet survey and vitamin intake was computed. The results of the study revealed that except carotene, thiamin, vitamin C intake, consumption of riboflavin, niacin, pyridoxine, folic acid free and vitamin B12 was found to be less than Recommended Dietary allowance for Indian adults in both elderly males and females. The intake of thiamine, niacin in elderly males and females and intake of folic acid free and vitamin C in elderly males showed a significant negative correlation with the age and the intake of thiamine, riboflavin, folic acid free, Vitamin C and Vitamin B12 showed positive correlation with number of meals consumed by elderly. Intake of vitamin C in elderly males and females positively associated with the educational qualification, consistency of meal and meals consumed with family whereas negatively with skipping of meals, fasting practices of elderly males.

Key Words: Elderly, Vitamin Intake, Meal Pattern, Skipping Of Meals, Consistency of Meals, Fasting, Correlations, Relationship.

The twentieth century saw a revolution in longevity and unprecedented ageing of population. Since 1950, the average life expectancy at birth has increased by 20 years. This is expected to increase by a further 10 years by 2050. The first quarter of the twenty-first century has often been called the Age of Ageing. Every month, 1,000,000 persons reach the age of 60. It is projected that by 2025, older persons will constitute almost 14.3 percent of the world's population amounting to almost 1.2 billion persons. The fastest growing groups of the older population are those aged 80 and over. In 2000, they numbered 70 million. By 2050, their numbers are projected to increase to more than five times. By the year 2020, one third of the population will be over 60 and by 2050, every third person on the planet will be over 60 [1]. According to World Heath Organization, the world's elderly population - people 60 years of age and older - is 650 million. By 2050, the "greying" population is forecast to reach 2 billion [2].

Ageing has been described as a process, which results from impaired immunological, genetic, neurological or endocrinological functions. Oxidative mechanisms are believed to play an important role in the ageing process. The free radical theory of ageing suggests an age related imbalance between pro-oxidant and antioxidant equilibrium, resulting in a potential decrease in antioxidant defenses. It is therefore important to emphasis the relationship between health and nutrition in the elderly, particularly with regard to the requirement of antioxidant micronutrients like β-carotene, vitamin C, E and B2, zinc and selenium. Lower intake of micronutrients can be due to lesser access to micronutrient-dense foods for economic/social reasons, dental problems, psychological problems (loneliness) and other health problems. Reduced bioavailability can be due to gastrointestinal problems, which interfere with absorption, or alterations in metabolism [3]. An adequate vitamin intake is essential for a good nutritional status, especially in older women, who are more sensitive to nutritional deficiencies. The American, European and Italian Recommended Dietary Allowances (RDAs) derive mainly from studies on adults, but Bolzetta *et al.* (2015) suggested that the current RDAs are adequate for older women's intake of riboflavin, vitamin B-6, and folic acid, but should be raised for vitamin B-12 and for vitamin C [4]. In view of the above discussion, the present investigation was undertaken to access vitamin intake of the elderly from central India.

Materials and Methods

The present, cross-sectional study was conducted on a sample of 400 elderly to assess their vitamin intake. 200 elderly males and 200 elderly females were selected through cluster sampling from Nagpur City, Maharashtra, India. The objectives of the study was conveyed/ briefed to each of the respondent before data collection to get proper response. The oral informed consent was also obtained from the respondent and were assured of confidentiality and privacy of data collected. The structured questionnaire was developed to elicit information. The socio-demographic attributes, dietary pattern and diet intake of the elderly was collected. Quantitative information on consumption of foods was obtained by 24 hours recall method of diet survey [8]. The nutritive value of raw foods was calculated using Nutritive Value of Indian Foods [9]. The vitamin intake was compared with Recommended Dietary Allowances, (RDA) for adult Indians suggested by the Expert Committee of ICMR (2009) [10].

Data Analysis

The data was tabulated and analyzed statistically. The data was classified according to sex and age (60-70 years and 70-80 years). The results were presented as the mean and standard deviation (M ± S.D.). *Chi* square test of independence was calculated for the assessment of association between the variables [11]. Comparison between the mean values of food, nutrient intakes was tested by "Z" test [12]. Correlation coefficient was computed using version windows 2007 for the assessment of correlation between the variables.

Results

Sociodemographic Characteristic of the Elderly

The demography of the elderly of the present study showed that higher proportions of elderly males (31.5 %) were in the age group of 65-70 years whereas 44% elderly females were from the age group of 60-65 years. 17.5% and 8.5% elderly males and females were in 75-80 years of age group whereas 29.5% and 22% elderly males and females were in the age group of 70-75 years respectively. All elderly belonged to Hindu religion. Except 0.5% males and 2 % females, majority elderly males (91.5%) and females (73.5%) were married. Large numbers of elderly males (50.5%) were staying with nuclear family whereas 50.5% females with extended families; however 1.5% males and 6.5% females were staying alone. Greater proportion of elderly females (55%) and elderly males (53.5%) had a family less or equal to four members whereas 14% and 10.5% of elderly males and females had a family more or equal to seven members respectively. A majority of elderly males (64%) were under graduate/post graduate or Ph.D. whereas majority females (48%) had education up to SSC/HSSC/ Inter or diploma. The rate of illiteracy was seen significantly (χ^2 = 43.75 P< 0.01) more in females (2.5%) as compared to males (0.5%). Only (23.5%) females were employed before the age of retirement. After the age of retirement, maximum 86% elderly males and 97.5% elderly females were not found to be employed. Pension was the main source of income for the majority of elderly males (70.5%) and females (76.59%) whereas life savings as the source of income was for 15.5% males and 2.12% females.

The average monthly income of elderly males was found to be Rs. 9,622 ± 5,760 where as for elderly females it was found to be Rs. 1,479 ± 3,479. The numbers of elderly males engaged in social activities were found to be significantly higher than elderly females (χ^2 = 21.44 p< 0.01). Only 37% elderly males and 16.5% females were found to be engaged in social activities.

Vitamin Intake of the elderly

Table 4 shows the average daily intake of vitamins among elderly by age and sex. Diet of both elderly males and females was found to be adequate in carotene, thiamine and vitamin C and rest of the vitamins viz., riboflavin, niacin, pyridoxine, folic acid and vitamin B12 were found to be inadequate. In elderly males, the mean daily intake of carotene was 2772.23 ±1416.79 ug, thiamine 1.39 ± 0.30 mg. and vitamin C 92.10 ± 16.68 mg. whereas in elderly females it was found to be 2785.35 ± 1179.45 ug, 1.21 ± 0.23 mg and 88.60 ± 13.67 mg respectively. Among both elderly males and females, the percent adequacy for vitamin C was highest [M:230.25%; F:221.5%], followed by thiamine [M:115.83%; F:134.44%], carotene [M:115.5%; F:116.05%], niacin [M:80.81%; F:93%], riboflavin [M:77.85%; F:91.81%], folic acid free [M:60.26%; F:56.04%], vitamin B12 [M:39%; F:36%] and lowest for pyridoxine [M:16.5% ; F:15%].

The intake of all vitamins in elderly males was found to be more in the age group of 60-70 years than 70-80 years. The mean intake of thiamin (z = 3.08 p<0.01), niacin (z = 2.67 p<0.01), folic acid free (z = 2.09 p<0.05) and vitamin C (z = 2.47 p<0.05) were found to be significantly higher in the age group of 60-70 years than 70-80 years. In elderly females, the mean daily intake of carotene, thiamine, niacin, folic acid and vitamin C was found be higher in age group of 60-70 years than 70-80 years whereas the mean consumption of riboflavin, pyridoxine and vitamin B12 was found to be more in the age group of 70-80 years than 60-70 years of age. The mean intake of niacin (z = 2.03 p<0.05) was found to be significantly higher in the age group of 60-70 years whereas the mean intake of vitamin B12 (z = 2.12 p<0.05) was found to be significantly higher in the age group of 70-80 years of age group.

Correlation Coefficient between Socio-Economic Profile, Dietary Pattern and Vitamin Intake of the Elderly

Age of elderly was found to be negatively and significantly correlated with thiamine [M: (r = -0.24 p<0.01); F: (r = -0.16 p<0.05)] and niacin intake [M: (r = -0.23 p<0.01); F: (r = -0.18 p<0.01)]. Age of elderly males showed negative correlation with folic acid free (r = -0.15 p<0.05) and vitamin C (r = -0.18 p<0.01) intake. Marital status of elderly males showed positive and significant association with pyridoxine (r = 0.18 p<0.01) intake. Whereas marital status of elderly females showed positive and significant association with carotene (r = 0.14 p<0.05) and vitamin C (r = 0.14 p<0.05) intake. Educational qualification of both elderly males (r = 0.18 p<0.01) and females (r = 0.16 p<0.05) was found to be significantly

and positively associated with vitamin C intake. Family size of elderly males correlated positively and significantly ($r = 0.18$ $p<0.01$) with pyridoxine intake. Family size of elderly females did not show any significant correlation with vitamin intake. There was no significant difference observed between the income and vitamin intake of elderly males. Income of elderly females showed positive relationship with pyridoxine ($r = 0.21$ $p<0.01$) intake and negative with vitamin C ($r = -0.21$ $p<0.01$) intake. Social involvement of elderly males and females did not show any significant association with vitamin intake (Table 5).

Food habits of elderly males and females did not show any significant relationship with vitamin intake. Intake of vitamin C was found to be significantly and positively correlated with consistency of diet consumed by both elderly males ($r = 0.17$ $p<0.05$) and elderly females ($r = 0.13$ $p<0.05$). Whereas in elderly females positive association was observed between consistency of meals consumed and thiamin ($r = 0.18$ $p<0.01$) and niacin ($r = 0.19$ $p<0.01$) intake. Meal timings and vitamin intake of elderly males and females did not show any significant association. Carotene [M :($r = 0.2$ $p<0.01$); F: ($r = 0.16$ $p<0.05$)] and vitamin C [M: ($r = 0.19$ $p<0.01$); F: ($r = 0.23$ $p<0.01$)] intake in elderly males and females were found to be positively and significantly correlated with meals consumed with family. Meals consumed with family of elderly males were found to be significantly and positively associated with, free folic acid ($r = 0.16$ $p<0.05$) intake. The positive and significant correlation was found between the number of meals consumed by elderly and thiamin [M: ($r = 0.34$ $p<0.01$); F: ($r = 0.14$ $p<0.05$)], riboflavin [M: ($r = 0.34$ $p<0.01$); F ($r = 0.38$ $p<0.01$)], folic acid [M: ($r = 0.13$ $p<0.05$); F: ($r =0.2$ $p<0.01$)] vitamin C [M: ($r = 0.13$ $p<0.05$); F: ($r = 0.18$ $p<0.01$)] and vitamin B12 [M: ($r = 0.39$ $p<0.01$); F: ($r = 0.51$ $p<0.01$) intake. Niacin intake ($r = 0.31$ $p<0.01$) was found to be positively correlated with number of meals consumed by elderly males. Receiving or cooked food from own home was found to be significantly and positively correlated with thiamin ($r = 0.16$ $p<0.05$), niacin ($r = 0.16$ $p<0.05$), pyridoxine ($r = 0.23$ $p<0.01$) and free folic acid ($r = 0.15$ $p<0.05$) intake in elderly males. Elderly females did not show any significant relationship between received food and vitamin intake. Skipping of meals in elderly males showed significant and negative correlation with vitamin C ($r = -0.13$ $p<0.05$) and vitamin B_{12} ($r = -0.15$ $p<0.05$) intake. Fasting practices of elderly males was negatively and significantly correlated with carotene ($r = -0.14$ $p<0.05$) and vitamin C ($r = -0.15$ $p<0.05$) intake. The negative and significant relationship was observed between modification of diet and thiamine ($r = -0.14$ $p<0.05$) and niacin ($r = -0.18$ $p<0.01$) intake in elderly females. There was no significant correlation between the unhealthy life style and vitamin intake of elderly males and females (Table 5).

Discussion

Results indicate that majority of elderly males and elderly females were from 60-70 years of age. All elderlies belonged to Hindu religion. Greater proportion of elderly males and elderly females were found to be married. Widows were more than widowers. Majority of elderly males and elderly females were found to be staying with nuclear family and extended family respectively. Higher proportion of elderly males and females had family size of one to four members. The rate of illiteracy was seen in a very few proportion of elderly males and females. The educational qualification of elderly males was significantly higher than elderly females. Before retirement, all elderly males and only ¼th proportion of studied elderly females were found to be employed. While after retirement, higher proportion of elderly males and females were not found to be employed. Pension was the main source of income for majority of elderly males and females. The average monthly income of elderly males was found to be Rs. 9,622 ± 5,760 where as for elderly females it was found to be Rs. 1,479 ± 3,479. For majority elderly males and elderly females the total monthly income of family ranged between Rs. 5,000 to 20,000/month. Majority of elderly males and females were not found to be participating in social organization. A majority of elderly males and females were found to be vegetarians, consuming 4-5 meals in a day, regular, taking meals with their family, not skipping their meals, consuming meals of normal consistency, consuming therapeutic diet, consuming foods cooked at home, mostly keeping fast yearly followed by monthly, having low unhealthy lifestyle habits.

In the present study it was observed that the average intake of carotene, thiamin and vitamin C in elderly was found to be higher than the Recommended Dietary Intake for adult Indians in both sexes. Whereas rest of the vitamins viz., riboflavin, niacin, pyridoxine, folic acid free and vitamin B12 were found to be consumed inadequately or less than Recommended Dietary Allowance by elderlies. The findings agree with previous studies carried out in rural India that the average intakes of all the important micronutrients, except thiamine and vitamin C were less than the RDA. When compared with international RDAs (FAO, 1998), the intakes of all the nutrients, except thiamin, were much lower [15]. The intake of vitamin C was found higher than the RDA in all the three income groups of elderly men in Baroda city. Though nutrient intake was not significantly different in all the income groups, β-carotene intake was found to be higher in elderly men from MIG than HIG [16]. All-day meals for residents provide adequate amounts of the micronutrients examined thiamine, riboflavin, niacin and vitamin C [17]. Micronutrient deficiencies, especially for D, B-6, and B-12 and folic acid were common in Ecuadorian elderly population [18]. Older adults who had a low BMI and consumed a low variety of micronutrient-dense foods were particularly

at nutritional risk, with only 65.4% consuming the Recommended Dietary Allowance for protein and none meeting the Estimated Average Requirements for all 14 micronutrients [19]. A study on elderly obese individuals revealed that poor diet quality and micronutrient deficiencies are relatively common concerns [20]. Suboptimal micronutrient intake for particular vitamins was found to be common in elderly [21].

In present study, the mean intake of niacin in elderly females while the intake of thiamin, niacin, folic acid free and vitamin C in elderly males was found to be significantly more in the age group of 60-70 years than 70-80 years. The lowered intake of vitamins by increasing age has also been reported in several studies. Among persons aged 65-74 and over 75 years, respectively, about 10% and 20% were at high risk of vitamin B-12 deficiency. About 10% of those with B-12 deficiency also had folate deficiency [22]. Dietary intake of vitamins C and B_1 were significantly lower for people aged 75 and older compared with people aged 65–74 [23]. The low intake of micronutrients in old nursing home residents aged 80 to 85 years was reported [24].

In the present study, the intake of thiamine, niacin, were found to be negatively and significantly correlated with age of elderly males and females while negative relationship was observed between intake of folic acid free, vitamin C and age of elderly males only. Educational qualification of elderly males and females was found to be positively and significantly correlated with vitamin C intake. Monthly income of elderly females showed negative and significant correlation with vitamin C intake. The same finding observed having a weekly household income of less than £ 150 was associated with low status of vitamin C [25].

In the present study, the vitamin C intake of elderly was found to be positively and significantly associated with consistency of diet consumed by elderly males and females. Carotene intake in elderly males and females was positively and significantly associated with meals consumed with family. The intake of thiamine, riboflavin, niacin, folic acid free, vitamin C and vitamin B12 were found to be significantly increased with increase in number of meals consumed by both elderly males and females. Similar finding was observed in previous study that having breakfast cereal less than once per week was strongly associated with low folate status, while having fresh fruit juice less than once per week, having had less than two portions of fruits and vegetables the previous day and believing that food is not important for health were strongly associated with low vitamin C status [25].

In this study, there was positive and significant association was found between thiamine, niacin, pyridoxine intake of elderly males with received or cooked food from home. Skipping of meals by elderly males showed negative correlation with vitamin C and vitamin B12 intake. The negative association was also observed between the fasting practices of elderly males and carotene and vitamin C intake. No significant association observed between the unhealthy life style and vitamin intake in elderly males and females.

Conclusion and Recommendations

This study attempted to provide the information about the actual intake of vitamin by both elderly males and females of 60-80 years from central India and the interrelationship between the socioeconomic as well as dietary pattern with vitamin intake. Present study shows that diet of both elderly males and females was adequate in carotene, thiamine and vitamin C and rest of the vitamins viz., riboflavin, niacin, pyridoxine, folic acid free and vitamin B12 were found to be consumed less than Recommended Dietary Allowance. It was also observed that the vitamin intake in both elderly males and females is influenced by increasing age and the number of meals consumed by them.

Along with the positive trend of increasing global health, however, come special health challenges for the 21st century viz., preparing health providers and societies to meet the needs of elderly people is essential; training for health professionals on old-age care; preventing and managing age-associated chronic diseases; designing sustainable policies on long-term care; and developing age-friendly services and settings.

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Annexure

Table 4 Average Daily Intake of Vitamins Among Elderly By Age And Sex

Age (Years)	N		Carotene (µg.)	Thiamin (mg.)	Riboflavin (mg.)	Niacin (mg.)	Pyridoxine (mg.)	Folic Acid Free (µg.)	Vitamin C (mg.)	Vitamin B12 (µg.)
Males										
60 – 70	106	Mean S.D. % Adequacy	2892.06 ± 1385.43 120.5	1.45 ± 0.27 120.8	1.12 ± 0.24 80	13.47 ± 2.78 84.18	0.34 ± 0.05 17	62.56 ± 14.78 62.56	94.85 ± 14.54 237.12	0.39 ± 0.19 39
70 – 80	94	Mean S.D. % Adequacy	2637.09 ± 1446.8 109.87	1.32 ± 0.32 110	1.07 ± 0.31 76.42	12.32 ± 3.24 77.0	0.33 ± 0.07 16.5	57.67 ± 17.91 57.67	89 ± 18.40 222.5	0.38 ± 0.19 38
60 – 80	200	Mean S.D. % Adequacy	2772.23 ± 1416.79 115.5	1.39 ± 0.30 115.83	1.09 ± 0.27 77.85	12.93 ± 3.05 80.81	0.33 ± 0.06 16.5	60.26 ± 16.46 60.26	92.10 ± 16.68 230.25	0.39 ± 0.19 39
RDA			2400	1.2	1.4	16	2	100	40	1
Z Test			1.26	3.08**	1.26	2.67**	1.14	2.09*	2.47*	0.37
Females										
60 – 70	139	Mean S.D. % Adequacy	2830.72 ± 1150 117.94	1.22 ± 0.24 135.55	1.0 ± 0.24 90.9	11.37 ± 2.55 94.75	0.30 ± 0.09 15	56.39 ± 14.47 56.39	88.92 ± 12.81 222.3	0.35 ± 0.16 35
70 – 80	61	Mean S.D. % Adequacy	2681.97 ± 1247.5 111.74	1.17 ± 0.20 130	1.03 ± 0.24 93.63	10.68 ± 2.04 89	0.31 ± 0.08 15.5	55.25 ± 13.55 55.25	87.87 ± 15.53 219.67	0.40 ± 0.15 40
60 – 80	200	Mean S.D. % Adequacy	2785.35 ± 1179.4 116.05	1.21 ± 0.23 134.44	1.01 ± 0.24 91.81	11.16 ± 2.42 93	0.3 ± 0.08 15	56.04 ± 14.17 56.04	88.6 ± 13.67 221.5	0.36 ± 0.16 36
RDA			2400	0.9	1.1	12	2	100	40	1
Z Test			0.79	1.52	0.81	2.03*	0.78	0.53	0.46	2.12*

* p < (0.05), ** p < (0.01), S.D. = Standard Deviation, RDA = Recommended Dietary Allowance

Table 5 Correlation Coefficient between Vitamin Intake and Socio Economic Profile of the Elderly

Variables	Sex	Carotene (ug.)	Thiamine (mg.)	Riboflavin (mg.)	Niacin (mg.)	Pyridoxine (mg.)	Folic acid Free(ug.)	Vitamin C (mg.)	Vitamin B12 (ug.)
Age	M	-0.08	-0.24**	-0.1	-0.23**	-0.1	-0.15*	-0.18**	0.008
	F	-0.11	-0.16*	-0.01	-0.18**	0.01	-0.12	-0.04	0.11
Marital Status	M	0.01	0.06	0.01	0.09	0.18**	0.03	-0.03	-0.03
	F	0.14*	-0.06	0.02	-0.04	-0.06	0.09	0.14*	-0.01
Educational Qualification	M	0.06	0.02	0.04	0.03	0.01	0.06	0.18**	0.01
	F	0.01	-0.07	0.03	-0.06	-0.06	-0.003	0.16*	0.08
Family Size	M	-0.11	0.04	-0.11	0.03	0.18**	-0.09	-0.12	-0.11
	F	-0.08	0.05	-0.05	0	0.12	-0.03	-0.1	-0.08
Monthly Income	M	-0.05	-0.05	0.04	-0.06	-0.05	-0.03	-0.04	0.09
	F	0.12	-0.11	-0.05	-0.11	0.21**	0.07	-0.21**	0
Social Involvement	M	0.04	0.09	0.08	0.09	-0.002	0.08	0.07	0.05
	F	-0.12	0.04	-0.02	0.05	-0.05	-0.08	0.11	0.04

Table 5 Correlation Coefficient between vitamin intake and dietary pattern of the Elderly

Variables	Sex	Carotene (ug.)	Thiamine (mg.)	Riboflavin (mg.)	Niacin (mg.)	Pyridoxine (mg.)	Folic acid Free(ug.)	Vitamin C (mg.)	Vitamin B12 (ug.)
Food Habits	M	-0.01	-0.08	-0.05	-0.1	0.1	-0.02	-0.05	-0.04
	F	-0.02	0.06	-0.03	0.03	0.07	0.01	-0.03	-0.12
Consistency Of Diet	M	0.02	0.02	-0.01	0.07	-0.02	0.01	0.17*	-0.03
	F	-0.06	0.18**	0.03	0.19**	0.01	0.01	0.13*	-0.004
Meal Timings	M	-0.06	-0.08	0.01	-0.05	-0.08	-0.08	-0.05	-0.07
	F	0.05	0.05	0.03	0.05	-0.03	0.05	0.03	-0.03
Meals Consumed With	M	0.2**	0.09	0.08	0.12	0.08	0.16*	0.19**	0.01
	F	0.16*	-0.06	0.01	-0.04	-0.04	0.08	0.23**	0.02
No. Of Meals	M	-0.09	0.34**	0.34**	0.31**	0.01	0.13*	0.13*	0.39**
	F	0.06	0.14*	0.38**	0.09	-0.1	0.2**	0.18**	0.51**
Received Food From	M	0.07	0.16*	0.02	0.16*	0.23**	0.09	0.02	0
	F	0.09	-0.06	-0.06	-0.06	-0.11	0.04	0.09	-0.02
Skipping Of Meals	M	-0.06	-0.04	-0.11	-0.05	0.05	-0.07	-0.13*	-0.15*
	F	0.08	0.04	-0.05	0.07	-0.07	0.04	-0.02	-0.06
Fasting Practices	M	-0.14*	-0.09	-0.02	-0.12	-0.1	-0.12	-0.15*	0.05
	F	0.004	0.01	-0.01	-0.005	-0.04	-0.006	-0.02	0.01
Modification Of Diet	M	-0.05	0.03	0.05	-0.03	0.05	0.03	0	0.04
	F	-0.06	-0.14*	-0.02	-0.18**	-0.12	-0.07	0	0.1
Unhealthy Life Style	M	0.05	0.11	0.1	0.08	0.02	0.1	0.08	0.04
	F	-0.1	-0.02	0.05	-0.04	-0.02	-0.03	0.04	0.08