KS Ip 葉健星
WTK Lee 李德強
JSH Chan 陳善珩
BWY Young 楊允賢

A community-based study of the prevalence of constipation in young children and the role of dietary fibre

兒童便秘的現患率、食用纖維與便秘的關係：社區研究

Objectives. To study the prevalence of constipation in young children, and to explore its association with dietary fibre intake.

Design. Cross-sectional community-based study.

Setting. Three kindergartens randomly selected from the eastern district of Hong Kong.

Participants. Between October 2003 and January 2004, parents of children aged 3 to 5 years completed a specially designed questionnaire and a 3-day dietary record form, which were used to collect information on bowel function and dietary intake. Children with constipation were identified based on Rome criteria. Children with normal bowel habits served as a comparison group.

Main outcome measures. Dietary intake of energy, protein, and dietary fibre.

Results. Of 778 children recruited, 561 complete sets of data were successfully obtained from the participating kindergartens. One hundred and sixty-six (29.6%) children were found to be constipated. The incidence of a family history of constipation was significantly higher in the constipated group (14%) than in the non-constipated group (7%) [P=0.013]. Mean dietary fibre consumption was 4.1 g/d (standard deviation, 2.3 g/d) in all children corresponding to 45.5% (standard deviation, 24.9%) of the daily recommendation. Constipated children (mean, 40.7%; standard deviation, 20.5%) had a significantly lower dietary fibre intake of the daily recommendation than the non-constipated group (mean, 47.5%; standard deviation, 26.2%) [P=0.017].

Conclusion. Up to 30% of preschool children in the eastern district had constipation. A family history of constipation was related to its occurrence in the studied children. Dietary fibre intake was insufficient in all children and even lower in those who were constipated.

目的：研究兒童患上便秘的普遍性，並探討便秘與食用纖維攝取量的關係。

設計：橫斷面社區研究。

安排：隨機揀選香港東區三間幼稚園。

參與者：2003 年 10 月至 2004 年 1 月期間，透過 3 至 5 歲兒童父母填寫的問卷和三天飲食資料記錄表，收集這些兒童的排便功能和飲食資料，並以「羅馬準則」為標準，界定患有便秘的兒童。其他排便正常的兒童則作為對照組。

主要結果測量：熱量、蛋白質和食用纖維的營養攝取量。

結果：在三間幼稚園778名參與的兒童當中，研究人員成功收集561個數據完整的個案。166名兒童（29.6%）被界定有便秘問題。便秘組中有家庭便秘病歷的比例（14%）明顯高於無便秘組（7%）[P=0.013]。研究對象的平均

Key words:
Child;
Constipation;
Dietary fiber;
Prevalence

關鍵詞：
兒童；
便秘；
食用纖維；
普遍性

Hong Kong Med J 2005;11:431-6

Department of Paediatrics and Adolescent Medicine, Pamela Youde Nethersole Eastern Hospital, Chai Wan, Hong Kong
KS Ip, FHKCPaed, FHKAM (Paediatrics)
JSH Chan, MB, BS, MRCPCH
BWY Young, FRCP, FHKAM (Paediatrics)
Centre of Nutrition and Food Safety, School of Biomedical and Molecular Sciences, University of Surrey, Guildford, Surrey GU2 7XH, United Kingdom
WTK Lee, PhD, RD

Correspondence to: Dr KS Ip
(e-mail: ipkinsing@yahoo.com)

食用纖維攝取量為每日 4.1 克（標準差為每日 2.3 克），只佔每日建議攝取量的 45.5%（標準差為 24.9%）。便秘組的食用纖維攝取量更低至每日建議攝取量的 40.7%（標準差為 20.5%），明顯少於無便秘組的攝取量（平均為 47.5%，標準差為 26.2%）[P =0.017]。

結論：香港東區約有30%學前兒童出現便秘問題，而家庭便秘病歷與兒童患上便秘有關。所有兒童的食用纖維攝取量都不足，便秘組的兒童情況尤甚。

Introduction

Constipation is a frequently overlooked health problem. It has been estimated in western countries that up to 10% of children have chronic constipation, but only 3% of parents seek medical advice.[1] The problem has also been reported to account for 3% of all visits to paediatric out-patient clinics,[2,3] and up to 25% of all referrals have been ultimately cared for by a paediatric gastroenterologist.[3] To date, there are a lack of local data concerning the prevalence of constipation in children. Studies have attributed a low dietary fibre intake to the pathogenesis of chronic idiopathic constipation.[4,5] The American Academy of Pediatrics (AAP) recommends a daily dietary fibre intake for children of 0.5 g/kg body weight, up to 35 g/d.[6] Williams et al[7] proposed a minimum daily fibre intake equivalent to age in years plus 5 g/d for children older than 2 years. Nonetheless dietary fibre consumption has remained low in many populations worldwide irrespective of these recommendations.[8] Over the last 30 years, diets among Hong Kong people have become more westernised, children are also moving away from the traditional Chinese diets abundant in vegetables, legumes, and fruits that are rich in dietary fibre, and are adopting affluent diets rich in animal products, refined carbohydrates, and fats. Dietary fat consumption has been shown to be significantly higher in Hong Kong Chinese children than in children from mainland China who eat a traditional diet.[9] Dietary fibre consumption has been shown to be markedly deficient in a group of Hong Kong adolescents.[10] We believe that this change in dietary patterns will have a negative impact on the health of our children. Nonetheless, the extent of constipation and the dietary fibre intake among young children in Hong Kong has not been studied. This study aimed to evaluate the magnitude of the problem of constipation in young children and its association with dietary fibre intake.

Patients and methods

Patients

We referred to a previous study[4] to determine the sample size for the present survey. In order to detect a difference in dietary fibre intake of 2.3 g/d with a statistical power of 80% and at a 5% level of significance between the constipation and the control groups, the sample size was estimated to be 100 per group. Based on a reported prevalence of constipation in children of 34%,[11] three kindergartens were randomly selected from the eastern district in Hong Kong, and young children aged between 3 and 5 years were recruited to the survey.

Assessment of bowel function

1. Do you think your child has constipation?
2. If yes, have you consulted doctors before for constipation?
3. In the past 3 months:
   How many bowel motions does your child have in a day/week?
   - ≥1/day
   - Every 2 days
   - 2/week
   - 1/week
   - <1/week

   What consistency are your child's stools?
   - Liquid/runny/mushy
   - Soft
   - Firm
   - Hard/dry

Methods

The cross-sectional survey was conducted between October 2003 and January 2004. A modified questionnaire (Box) was used to collect information on habitual bowel function during the past 3 months.[12] A 3-day dietary record was completed to obtain information on dietary fibre and macronutrient intake.[4,13,14] Parents were given a 3-day supply of diet record form and an instruction guide; they had been briefed on the recording method by the investigators prior to the study. The 3-day period included two consecutive weekdays and a weekend day. Parents were reminded to maintain the child's food habits during the survey period and to provide a detailed description of the foods eaten, eg white or wholemeal bread, peeled or unpeeled fruits, types of breakfast cereals and biscuits, portions of vegetables and fruits, etc. Household measures such as cups, bowls, tablespoons, and food pictures were used to aid description of food portions and quantities.[15] Parents were instructed to measure the amount of each food item of the meal separately before it was served and to

measure the quantities of food left over after a meal. Average daily energy and nutrient intake of the 3-day food record of each child were determined by a computerised database with food items compiled from published food tables for the study of dietary intake in the Chinese population.[9,10,15] Nutrient compositions of commercially manufactured foods were obtained from the manufacturers.

Outcome measures and data analysis

The bowel habits of the studied children were investigated to identify those with constipation. Constipation was defined as at least 2 weeks of passing scybalous, pebble-like, and hard stools for a majority of the stools; or passing firm stools 2 or less than 2 times per week (Rome criteria).[16] Children with normal bowel function served as a comparison group. The primary outcome measures were the prevalence of childhood constipation and the amount of daily dietary fibre intake. Daily dietary fibre intake was tabulated as the percentage of daily recommendations (AAP[6]). Continuous variables were compared by Student's *t* test, and categorical variables by Chi squared test or Fisher's exact test. Dietary fibre intake was also compared with the recommendation from Williams et al[7] using intraclass correlation. The agreement of the percentage daily recommended dietary fibre intakes obtained from the two recommendations[6,7] was analysed by using intraclass correlation coefficient (ICC).[17] Poor agreement (ICC<0.40), fair-to-good agreement (0.40≥ICC≥0.75), and excellent agreement (ICC>0.75) have been well defined.[18] Statistical analysis was performed using the Statistical Package for the Social Sciences (Windows version 11.0; SPSS Inc, Chicago [IL], United States). The level of significance was set at a P value of less than 0.05.

Results

A total of 778 children were recruited from three kindergartens. Of these, 217 children were excluded because of incomplete questionnaires. A total of 561 completed questionnaires were available of whom 166 were found to have constipation, ie an estimated prevalence of 29.6%. Of the constipated children, 70 (42%) parents were aware of the problem, 38 (23%) had sought medical advice, and 97 (58%) believed their child's problem could be managed by dietary manipulation alone.

Characteristics of the constipated and the non-constipated groups are summarised in Table 1. Baseline characteristics including sex, age, place of birth, years of stay in Hong Kong, presence of co-morbidity, and family income were not significantly different between the two groups (P>0.05). A family history of constipation (either parent) was significantly more common in the constipated group (13.9%) than in the non-constipated group (7.3%) [P=0.013]. There was no significant difference between the two groups in the number of times eating out a week or the types of restaurant chosen (P>0.05).

A total of 189 3-day diet records were excluded from analysis because of missing data. Baseline characteristics did not differ significantly between the drop-out and the recruited cases (P>0.05). Hence, 372 children with completed questionnaires and 3-day diet record forms were included for dietary analysis. Baseline characteristics including sex, age, place of birth, years of stay in Hong Kong, presence of co-morbidity, and family income remained similar between the constipated and the non-constipated groups (P>0.05). Likewise a family history of constipation in the constipated group remained significantly higher (15.5% vs 8.0%, P=0.031). Dietary intake of energy, protein, and dietary fibre are shown in Table 2. There was no significant difference between the constipated and non-constipated groups in dietary intake of energy, protein, or dietary fibre (Table 2).

The mean daily dietary fibre intake for all children was 4.1 g (standard deviation [SD], 2.3 g), equivalent to 45.5% (SD, 24.9%) of the daily recommended intake.[6] A comparison was made between the two recommendations for dietary fibre intake (Fig): the ICC was 0.95; 95% CI, 0.939-0.960 (P<0.0001) indicating that agreement between the two recommendations was excellent. The major sources of dietary fibre were cereals (38%), fruits (31%), and vegetables (24%). There were no significant differences between the constipated and non-constipated groups in the sources of dietary fibre (P>0.05). The constipated group had a markedly lower daily intake of dietary fibre than the non-constipated group (mean, 3.7 g/d; SD, 2.0 g/d vs mean, 4.2 g/d; SD, 2.4 g/d, respectively). This corresponds to 40.7% (SD, 20.5%) and 47.5% (SD, 26.2%) [P=0.017] of the daily recommended intake,[6] respectively.

Discussion

This is the first survey on the extent of constipation, the amount of dietary fibre intake, and factors associated with constipation among young children in Hong Kong. We have estimated the prevalence of constipation in young children to be 29.6%. The problem of childhood constipation was overlooked by

Table 1. Characteristics of the constipated and the non-constipated groups of 561 Hong Kong children aged 3 to 5 years

Characteristic	Constipated group, n=166	Non-constipated group, n=395	P value
Sex			0.166*
Male	81 (48.8%)	218 (55.2%)	
Female	85 (51.2%)	177 (44.8%)	
Mean age (SD) [years]	4.12 (0.89)	4.21 (0.91)	0.289†
Born in Hong Kong			0.906*
Yes	146 (88.0%)	346 (87.6%)	
No	20 (12.0%)	49 (12.4%)	
Mean duration of stay in Hong Kong (SD) [years]	3.88 (1.05)	3.94 (1.11)	0.594†
Co-morbidity			0.700‡
Yes	6 (3.6%)	12 (3.0%)	
No	160 (96.4%)	383 (97.0%)	
Illness			0.282‡
Asthma	6 (3.6%)	7 (1.8%)	
Allergic rhinitis	0	3 (0.8%)	
Eczema	0	2 (0.5%)	
Either parent is constipated			0.013*
Yes	23 (13.9%)	29 (7.3%)	
No	143 (86.1%)	366 (92.7%)	
Family monthly income (HKD)§			0.933*
<20 000	55 (39.6%)	136 (40.2%)	
20 000-29 999	30 (21.6%)	68 (20.1%)	
30 000-39 999	27 (19.4%)	61 (18.0%)	
≥40 000	27 (19.4%)	73 (21.6%)	
Mean No. of times per week eating out (SD)			
Eating-out	2.70 (1.84)	2.82 (2.02)	0.511†
Eating-out at fast-food shops	0.68 (0.66)	0.66 (0.71)	0.773†
Eating-out at Chinese restaurants	0.89 (0.94)	0.91 (0.94)	0.815†
Eating-out at other restaurants	0.97 (1.12)	1.09 (1.19)	0.371†

* Chi squared test
† Student's *t* test
‡ Fisher's exact test
§ 27 and 57 sets of data were missing in the constipated and non-constipated groups, respectively

Table 2. A comparison of macronutrients and dietary fibre intakes between the constipated and the non-constipated groups*

Characteristic	Constipated group, n=110	Non-constipated group, n=262	P value
Nutrient intakes			
Energy (kcal/d)	1400 (442)	1420 (376)	0.678
Protein (g/d)	60.3 (21.5)	60.5 (17.2)	0.915
Dietary fibre (g/d)	3.7 (2.0)	4.2 (2.4)	0.088
Percent adequacy of dietary fibre intake†	40.7 (20.5)	47.5 (26.2)	0.017
Sources of dietary fibre			
Cereals (%)	40.7 (21.5)	36.8 (19.1)	0.085
Fruits (%)	30.0 (20.6)	31.6 (19.5)	0.479
Vegetables (%)	23.8 (16.7)	24.4 (15.7)	0.734

* Data are expressed as mean (SD)
† Compared with the American Academy of Pediatrics recommendation[6]

our study subjects: more than 40% of parents were unaware of the problem in their children, and only 23% had sought medical advice. The rate of constipation in parents of constipated children was double that of the non-constipated ones. This implies that positive confounding factors that are present in the same family, such as inherited factors, psychological factors, lifestyle, and dietary habits may predispose members of the family to chronic constipation, albeit the majority of parents in either group did not have constipation.

Dietary intake of energy and protein compared well with the Chinese dietary reference intakes[19] for energy (1400 kcal/d) and protein (50 g/d) in children aged 3 to 5 years implying that all the studied children were well nourished. It is a general belief that diet plays an

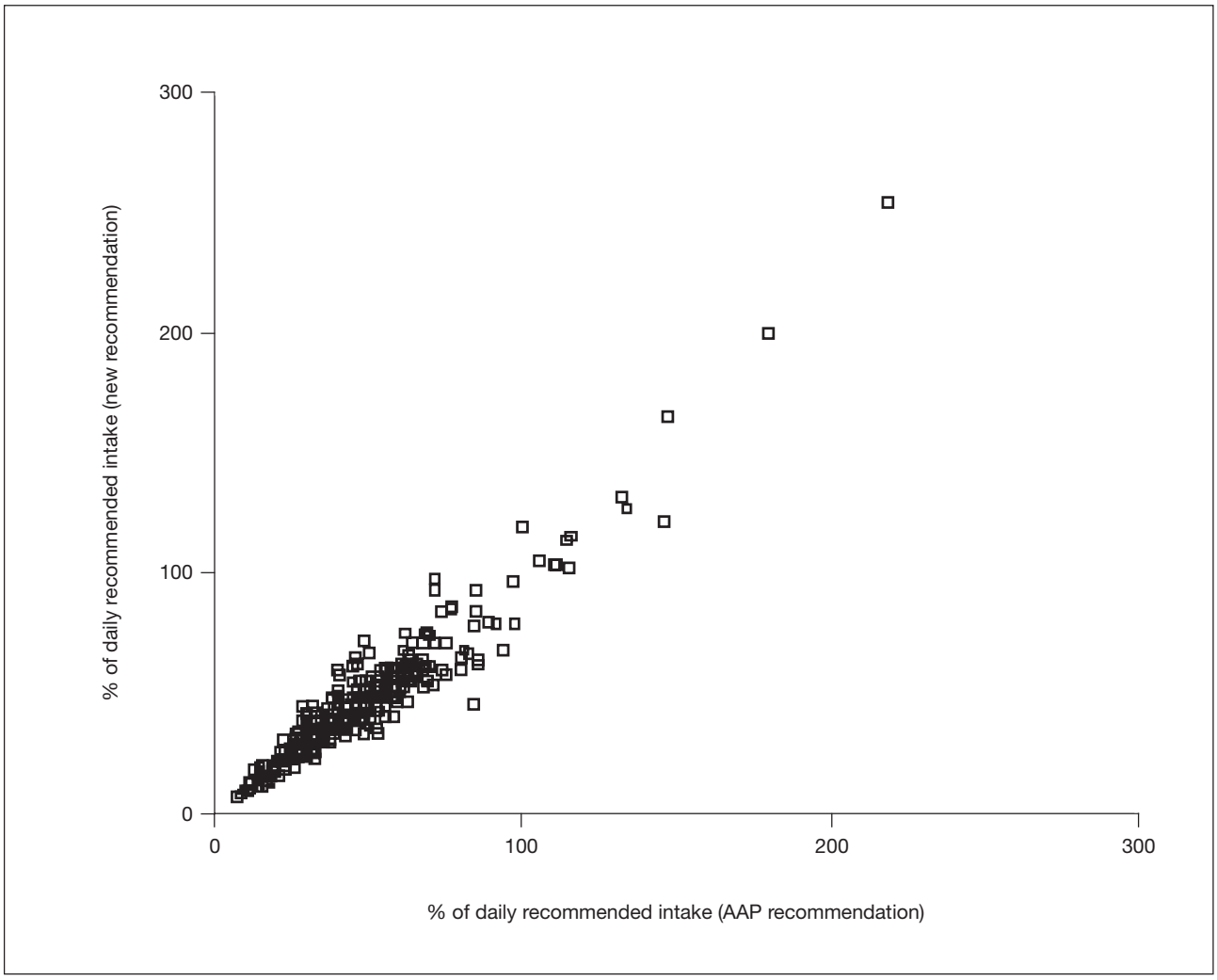

Fig. Intraclass correlation of percent adequacy of dietary fibre consumption of the studied children by comparing two sets of recommendations[6,7]
Intraclass correlation coefficient=0.95; 95% CI, 0.939-0.960; P<0.0001

important role in the pathogenesis of constipation; we have shown that 58% of parents of constipated children believed that constipation could be managed with dietary manipulation alone. We did not investigate how they planned to accomplish this and further exploration is required.

Insufficient dietary fibre intake is involved in the pathogenesis of constipation and has been proven in case-control studies.[4,5] There are two mechanisms that explain the protective role of fibre in constipation—osmotic and mechanic stimulation of colonic motility.[4] Short-chain fatty acids produced in the large intestine as a result of bacterial decomposition of fibre increases osmotic load, whereas mechanical stimulation is accomplished by the water-retaining capacity of indigestible dietary fibre to soften the stools. Furthermore, an increased colonic flora mass and the gas produced during colonic fermentation of fibre all enhance intestinal motility to expedite passage of stools in the large intestine.

The purpose of the present study was to investigate the role of dietary fibre intake in association with constipation in local children. No single assessment method is ideal to precisely estimate nutrient intake.[13] Research has found that a 3-day dietary record is an appropriate method in epidemiological studies to collect information about nutrient intake and represents current dietary patterns.[20,21] In addition, parents of constipated children may have completed the diet records more cautiously and simply because they were more concerned about the problem. They may also have received advice from their family physicians about the problem of constipation. This may explain why we failed to detect a significant difference in the absolute intake of dietary fibre between the two groups. Another reason is that the sample size may not have

been sufficient to detect a small difference of 0.5 g/d of mean dietary fibre. Nonetheless, there was a general under-consumption of dietary fibre by this group of children. In the present study, the daily dietary fibre intake approximated 46% of the daily recommendation. This finding is nonetheless consistent with a survey on the dietary practice of Hong Kong adolescents.[10]

The current study has shown that the two sources of recommended dietary fibre intake correlated closely. The recommendation that a minimum daily fibre intake be equivalent to age in years plus 5 g/d for children older than 2 years[7] provides a relatively easier way for clinicians and parents to calculate the required daily intake.[6] Although a low dietary fibre intake and a positive family history of constipation could be two of the causative factors for constipation in the studied children, these cannot explain the cause of idiopathic constipation in all cases. In future studies, factors such as the amount of fluid intake, behavioural influences, and toilet training should also be studied as they may play a role in the pathogenesis of constipation.

Conclusion

Up to 30% of preschool children in the eastern district were found to be constipated. A family history of constipation was related to its occurrence in the studied children. There was a general under-consumption of dietary fibre in young children, and constipated children had a remarkably lower fibre intake. The age plus 5 g/d recommendation for minimum daily dietary fibre consumption provides an easy reference for clinicians and parents. Further studies are required to investigate the effect of increasing dietary fibre consumption on the prevention and management of constipation, and to identify other factors that may be involved in the pathogenesis of childhood constipation, such as daily fluid intake, behavioural influences, and toilet training.

References

1. Loening-Baucke V. Functional constipation. Semin Pediatr Surg 1995;4:26-34.
2. Loening-Baucke V. Constipation in early childhood: patients characteristics, treatment, and longterm follow up. Gut 1993; 34:1400-4.
3. Murphy SM. Organic causes of constipation: diagnosis and management. Semin Pediatr Gastroentero Nutr 1992;2:4-8.
4. Roma E, Adamidis D, Nikolara R, Constantopoulos A, Messaritakis J. Diet and chronic constipation in children: the role of fiber. J Pediatr Gastroenterol Nutr 1999;28:169-74.
5. Morais MB, Vitolo MR, Aguirre AN, Fagundes-Neto U. Measurement of low dietary fiber intake as a risk factor for chronic constipation in children. J Pediatr Gastroenterol Nutr 1999;29:132-5.
6. Carbohydrate and dietary fiber. In: Kleinman RE, editor. Pediatric nutrition handbook. 4th ed. Elk Grove Village, IL: American Academy of Pediatrics; 1998:203-11.
7. Williams CL, Bollella M, Wynder EL. A new recommendation for dietary fiber in childhood. Pediatrics 1995; 96:985-8.
8. Loening-Baucke V, Miele E, Staiano A. Fiber (glucomannan) is beneficial in the treatment of childhood constipation. Pediatrics 2004;113:e259-64.
9. Leung SS, Lee WT, Lui SS, et al. Fat intake in Hong Kong Chinese children. Am J Clin Nutr 2000;72(5 Suppl):1373S-1378S.
10. Lee WT, Leung SS, Leung DM. The current dietary practice of Hong Kong adolescents. Asia Pacific J Clin Nutr 1994;3: 83-7.
11. Yong D, Beattie RM. Normal bowel habit and prevalence of constipation in primary-school children. Ambul Child Health 1998;4:277-82.
12. Yanchar NL, Soucy P. Long-term outcome after Hirschsprung's disease: patients' perspectives. J Pediatr Surg 1999;34: 1152-60.
13. Marr JW. Individual dietary surveys: purposes and methods. World Rev Nutr Diet 1971;13:105-64.
14. Hackett AF, Rugg-Gunn AJ, Appleton DR. Use of a dietary diary and interview to estimate the food intake of children. Human Nutr Appl Nutr 1983;37:293-300.
15. Leung SS, Chan SM, Lui S, Lee WT, Davies DP. Growth and nutrition of Hong Kong children aged 0-7 years. J Paediatr Child Health 2000;36:56-65.
16. Rasquin-Weber A, Hyman PE, Cucchiara S, et al. Childhood functional gastrointestinal disorders. Gut 1999;45(Suppl 2): II60-8.
17. Shrout PE, Fleiss JL. Intraclass correlations: uses in assessing rater reliability. Psychol Bulletin 1979;2:420-8.
18. Fleiss JL. The design and analysis of clinical experiments. New York: Wiley; 1986.
19. Chinese dietary reference intakes. Beijing, China: Chinese Light Industry Press; 2000.
20. Johansen HL, Neutel CI. Epidemiological studies in nutrition: utility and limitations. J Nutr 1988;118:137-9.
21. Barrett-Connor E. Nutrition epidemiology: how do we know what they ate? Am J Clin Nutr 1991;54(1 Suppl): 182S-187S.