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ORIGINAL ARTICLE

FILNUT-scale: Rationale and use in screening for malnutrition risk within the INFORNUT process

J.L. Villalobos Gámez,[a,b,*] J.M. Guzmán de Damas,[a] J.M. García-Almeida,[b] M.M. Galindo,[a] R. Rioja Vázquez,[b] A. Enguix Armada,[c] and O. Bernal Losada[d]

[a]*Servicio de Farmacia, Sección de Nutrición, Hospital Virgen de la Victoria, Málaga, Spain*
[b]*Equipo de Soporte Nutricional, UGC de Endocrinología y Nutrición, Hospital Virgen de la Victoria, Málaga, Spain*
[c]*Servicio de Laboratorio de Análisis Clínicos, Hospital Virgen de la Victoria, Málaga, Spain*
[d]*Servicio de Sistemas de Información y Desarrollos Informáticos, Hospital Virgen de la Victoria, Málaga, Spain*

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MUST Filnut-scale

Abstract
Objectives: To offer a rationale for assigning a minimum score for risk of malnutrition for total proteins lower than 5 g/dl and a scoring scale for our filter (FILNUT-scale); and to analyse results of the MUST screening test performed on positive scores in the FILNUT nutritional filter and assess usefulness of said test in this population.
Methods: We searched the laboratory database for laboratory test orders (dated between 2004 and 2007) for which total proteins and albumin or cholesterol levels were determined, and we identified those with results for the above three parameters plus lymphocyte count. A limit (less than 5 g/dl) was placed on the total protein level and the results for other parameters were not limited. Distribution curves for albumin and cholesterol were analysed. The same protocol was followed after establishing the CONUT score for each sample with the necessary parameters.
From September 2007 to January 2008, the MUST test was performed on all FILNUT positives and we analysed how the degrees of risk corresponded.
Results: In 95%of the cases in which total proteins are lower than 5 g/dl (n=1,176), albumin values are between 0.98 and 2.94 g/dl, resulting in CONUT scores of 4 or 6 for albumin. Regarding total cholesterol, (n=761) 89.1%of the samples are lower than 180 mg/dl, which accounts for one or two points in the score.
In 98.79% of the cases (n=490) that presented all four parameters, CONUT score was ≥5, which could be classified as medium or high risk.
During the study period, 100% of the patients identified as medium or high risk by the FILNUT-scale (n=568) tested as at-risk by MUST: of these, 421 (74.1%) were at high risk and 147 (25.9%) were at medium risk.

*Corresponding author.
E-mail address: juanl.villalobos.sspa@juntadeandalucia.es (J.L. Villalobos Gámez).

Conclusions: Total proteins lower than 5 g/dl determine a medium or high risk of malnutrition where a complete nutritional screening profile is lacking. This is why it should be included in the FILNUT-scale with a score of five points. Performing the MUST test on patients with five or more points is efficient and provides clinical data needed for a complete assessment.

PALABRAS CLAVE
Cribaje nutricional;
Riesgo desnutrición;
Proteínas totales;
Perfil nutricional;
CONUT;
FILNUT-escala
INFORNUT;
MUST

FILNUT-escala: justificación y utilidad en el cribaje de riesgo por desnutrición dentro del proceso INFORNUT

Resumen
Objetivos: Justificar la asignación de una puntuación de riesgo de desnutrición para proteínas totales inferiores a 5 g/dl y proponer una escala de puntuación para nuestro filtro (FILNUT-escala). Analizar el resultado del test de cribaje MUST (Malnutrition Universal Screening Tool) practicado en positivos al filtro nutricional Filtro de Nutrición y evaluar la utilidad de dicho test en esta población.
Métodos: Búsqueda en base de datos de laboratorio (años 2004-2007) de peticiones analíticas en que había determinación de proteínas totales y albúmina, o colesterol total, y aquellas que tenían resultados para esos 3 parámetros más el recuento de linfocitos. Sobre ello se impuso la limitación a las proteínas totales de ser menores de 5 g/dl, dejando libre el resultado del resto de parámetros. Se analizaron las curvas de distribución correspondientes, los valores de albúmina y colesterol; igualmente se procedió tras establecer las puntuaciones Control Nutricional (CONUT) correspondientes a las muestras con los parámetros necesarios.
En el periodo septiembre 07-enero 08 se practica MUST a todos los positivos Filtro de Nutrición y se analiza la correspondencia de grados de riesgo.
Resultados: Para proteínas totales inferiores a 5 g/dl, en el 95% de los casos (n = 1.176) los valores de albúmina estarán entre 0,98-2,94 g/dl; por tanto se obtendrían puntuaciones CONUT por albúmina de 4 o 6. En cuanto al colesterol total (n = 761), el 89,1%de las muestras queda por debajo de 180 mg/dl; correspondiéndose con 1 o 2 puntos. En el 98,79%de los casos (n = 490) que tenían los 4 parámetros la puntuación CONUT fue ≥ 5, que se catalogaría de riesgo de medio o alto.
Durante el periodo en estudio, el 100%de los pacientes de riesgo medio o alto en FILNUT-Escala (n = 568) dieron riesgo MUST: 421 (74,1%) alto y 147 (25,9%) medio.
Conclusiones: Proteínas Totales inferiores a 5 g/dl determinan riesgo medio o alto de desnutrición a falta de un perfil de cribaje nutricional completo. Ello justifica su inclusión con 5 puntos en FILNUT-Escala. La realización del test MUST a los pacientes con 5 o más puntos es eficiente y aporta datos clínicos necesarios para la valoración completa.

Introduction

Hospital malnutrition is known to be a frequent problem in patients who are hospitalised. It is accepted that this problem affects 10%-85%of the patients, according to the type of patient (elderly, children, medical, surgical, oncological patients, etc.), the category of the hospital, and the nutritional scoring markers used for evaluating patient status. It is internationally accepted that 30%-50%of hospitalised patients have malnutrition.[1-5]

Malnutrition is also known to increase with duration of hospital stay and to respond to several factors. The initial disease and diagnostic/therapeutic processes can also contribute to the development of malnutrition, but questionable dietetic indications also exist, with unattractive menus, poor-quality ingredients, and occasionally deficient diet protocols that are poorly adapted to patient needs. And finally, we also must not forget the lack of sensitivity to this problem by health professionals, due to both the meagre education in nutrition, the lack of knowledge on the importance of nutrition for patient evolution and on the existence of available nutritional support systems, which translates into poor application of detection and control mechanisms for patients with nutritional problems, as well as a poor use of existing nutritional support resources.[6-9]

From an economic point of view, malnutrition has been demonstrated to increase the costs associated with prolonging the duration of hospital stay, as well as the costs associated with the additional treatment given for its associated complications.[10-13]

However, the reality is that we do not have the necessary resources for evaluating the nutritional state of every patient that is admitted to the hospital. As such, it is accepted that we should use screening tools that will allow us to perform an initial evaluation in order to facilitate early detection of malnourished patients or those at risk of

malnutrition, and then evaluate these patients at a more specific level, applying a nutritional treatment plan when necessary. In short, we must rigorously select the patients that would benefit from nutritional treatment.[14,15]

The screening methods must be valid, reliable, reproducible, practical (easy to apply, well accepted, and economical), and associated with specific treatment protocols.[16] Ideally, this screening would take place upon admission to the hospital by the hospital nursing staff.[17-19]

Screening methods can be clinical, automated, or mixed. The majority of clinical screening methods include subjective and objective information (weight, height, change in weight, change in intake, comorbidity, etc.) Automated methods are mainly based on analytical data, although they also take other useful objective screening data that are available in the database of the hospital operating system (diagnosis, age, duration and evolution of affliction, resources used, etc.) Mixed methods also incorporate clinical and anthropometric parameters needed for completing the nutritional evaluation. We refer to several of these in this paper: *Malnutrition Universal Screening Tool* (MUST[20,21]); *Nutrition Risk Screening (NRS 2002[22])*; *Control Nutricional (Nutritional Control) (CONUT[23,24])*; and our mixed method: *FILNUT Filtro de Nutrición (Nutrition Filter) and INFORNUT proceso (process)*[25,26]. This is an automated screening process for the systematic early detection and evaluation of malnourished patients when admitted to the hospital, as well as for creating the documentation and report, which we apply in the nutritional support team at the Hospital Virgen de la Victoria (Virgen de la Victoria Hospital) in Malaga. We set the following *objectives* for this study:

We proposed a new scoring system for risk of malnutrition (FILNUT scale). To this end, we looked for relationships between TP values <5 with albumin levels (ALB) and total cholesterol (COL) from the same sample, as well as the point score obtained under the CONUT method (Table 1), analysing the parameters used in this type of filter. We justified the assignment of a score corresponding to risk of malnutrition for TP <5 and included this in our FiLNUT-scale proposal. Finally, we analysed the results of the MUST screening test in patients with positive results in the FILNUT nutritional filter (F(+)), and evaluated the usefulness of the test when employed in this population.

Method

In order to improve comprehension of the experimental work, we will perform a brief summary of the systematics in the INFORNUT process.

In its *1st phase: analytical nutritional filter* (which we call FILNUT), the conditions applied are: ALB<3.5 g/dl and/or total protein (TP)<5 g/dl and/or prealbumin (PRE)<18 mg/dl with or without total lymphocytes (LYM)<1600 cel/ml and/or COL<180 mg/dl; hospital admission data are incorporated into these values. Then follows a 2nd *phase: recording clinical data,* in which the program continues to integrate information from the MUST test (performed by the nurse responsible for each patient), which can be modified in order to quantify the time period of weight loss, for all patients that were designated as at-risk FILNUT as seen on a visual control screen used by the head nurse. The survey also records quartiles of ingestion during the previous time period defined by the NRS-2002 method. In the 3rd *phase: evaluation and report* (INFORNUT phase), the program assigns a "Diagnostic Orientation" based on an algorithm that follows the guidelines of the "*Documento SENPE-SEDOM sobre la codificación de la desnutrición hospitalaria*"[26] (SENPE-SEDOM document on the categorisation of hospital malnutrition). With these data, a treatment orientation is produced according to the "*Algoritmo de decisión ante Informe de Riesgo por Desnutrición*" (Malnutrition risk report decision algorithm) approved by the nutrition commission at our centre. Following the recommendations of the II Foro de SENPE[27] (II SENPE Congress) the final screening result will be presented in the format of a nutritional risk report in order to inform the attending physician and for consistency in the documentation of the clinical history. Logically, the entire process is directed towards a 4th *phase: nutritional intervention.* The INFORNUT process performs a teaching function for hospital faculty and nursing staff, facilitates the elaboration of a hospital discharge report. It can be classified by the department of clinical documents[28] and it has few requirements in terms of time and direct costs, all of which support this system as an efficient tool for nutritional screening of patients during the first 3 days after hospital admission.[29,30]

The experimental work of our study was performed in 3 stages:

1. We performed a retrospective search in the laboratory database for all labwork that displayed TP and ALB values (4 years, 2004-2007) or TP and COL (3 years, 2004–2006). We then imposed the condition of TP<5, disregarding ALB and COL levels. We then analysed the distribution curves created by these parameters, *P*, and/or 95%confidence intervals.
2. We then performed another search in the laboratory database over a 3-year period (2004-2006) of all requests for labwork in which TP, ALB, LYM, and COL (in the same sample) were measured. We then imposed the condition

Table 1 CONUT alert for nutritional risk

Parameter	Normal	Mild	Moderate	Severe
Albumin, g/dl	≥3.50 (0)	3.00-3.49 (2)	2.50-2.99 (4)	<2.50 (6)
Cholesterol, mg/dl	≥180 (0)	140-179 (1)	100-139 (2)	<100 (3)
Lymphocytes, mm^3	≥1600 (0)	1200-1599 (1)	800-1199 (2)	<800 (3)
Total range	0-1	2-4	5-8	9-12
ALERT Risk of malnutrition	LOW		MEDIUM	HIGH

Table 2 Analytical classification of nutritional risk according to the FILNUT-Scale score

Risk of malnutrition	No risk	Low	Average	High
ALBUMIN, g/dl	≥3.5	3.49-3	2.99-2.5	<2.5
Points	0	2	4	6
Serum prealbumin,* mg/dl	≥18	17.99-15.01	15-10	<10
Points	0	2	4	6
Local protein,** g/dl		≥5	<5	
Points		0	5	
LYMPHOCYTES,*** cel/min	≥1600	1599-1200	1199-800	<800
Points	0	1	2	3
CHOLESTEROL,*** mg/dl	≥180	140-179	100-139	<100
Points	0	1	2	3
Total score	0-1	2-4	5-8	9-12

*Taken when prealbumin is recorded with a higher score than that of albumin.
**Taken when neither albumin nor prealbumin were available.
***Only recorded when protein parameters were scored.

Table 3 Albumin values for TP<5

No.=1176* (2004-2007)	ALB, g/dl	TP, g/dl
Mean	1.96	4.53
Deviation	0.49	0.40
Median	1.96	4.62

ALB indicates albumin; TP, total protein.
*Samples correspond to 945 patients in 20 clinical units.

of TP<5, disregarding the other parameters. We then established the corresponding CONUT scores and calculated mean, SD, and median. We analysed the distribution curves of the CONUT score for the resulting population.

3. Between September 2007 and January 2008, we applied the MUST test to all F(+) within the INFORNUT process. We later classified these patients according to level of risk and analysed the relationship between MUST and FILNUT according to the scores obtained. In order to classify analytical nutritional risk, we used a risk point score which we called the FILNUT-scale (Table 2).

Results

TP vs ALB: We found 1176 pairs of values corresponding to a sample of 947 patients in 20 clinical units. The distribution curve and values of ALB for TP<5 are summarised in Table 3 and Figure 1. Considering the confidence interval, we can affirm that 95%of patients in this population would have ALB values between 0.98 and 2.94; as such, CONUT scores for ALB in patients with TP<5 would be 4 or 6.

TP vs COL: We found 761 pairs of values corresponding to 648 patients in 18 clinical units. The distribution curve and values of COL for TP<5 are summarised in Table 4 and Figure 2. According to this distribution, 72.6%of samples are below 140 and 89.1%are below 180. Only 10.1%would be outside of 1 or 2 points for COL on the CONUT score.

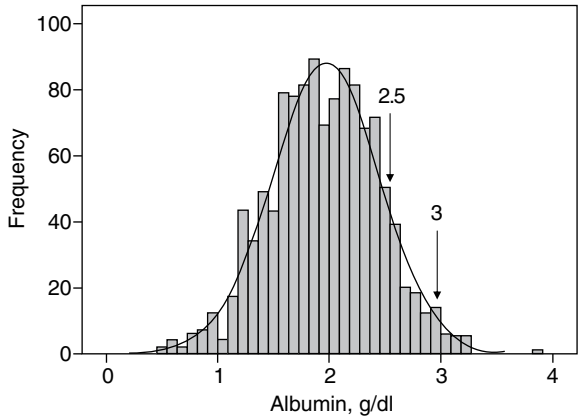

Figure 1 Distribution curve of albumin (ALB) for total protein (TP)<5.

Table 4 Total cholesterol values for TP<5

No.=761* (2004-2006)	COL	TP
Mean	116.97	4.59
Deviation	46.25	0.35
Median	108	4.66

COL indicates cholesterol; TP, total protein.
*Samples correspond to 648 patients in 18 clinical units.

TP vs CONUT: We obtained a population (n=496; TP<5) in which the distribution of TP was such that: mean=4.63, SD=0.32, and median=4.7. After applying the CONUT score, we obtained a distribution curve such that: mean=9.25, SD=1.86, and median=9. In 98.79%of cases (n=490) we obtained a CONUT score ≥5, which would be classified as moderate to high risk; being high (≥9) in 68.34% of cases (Table 5 and Figure 3).

During the study period, and with FILNUT results of 46.5% for admissions with >2 days duration, 790 patients were F(+),

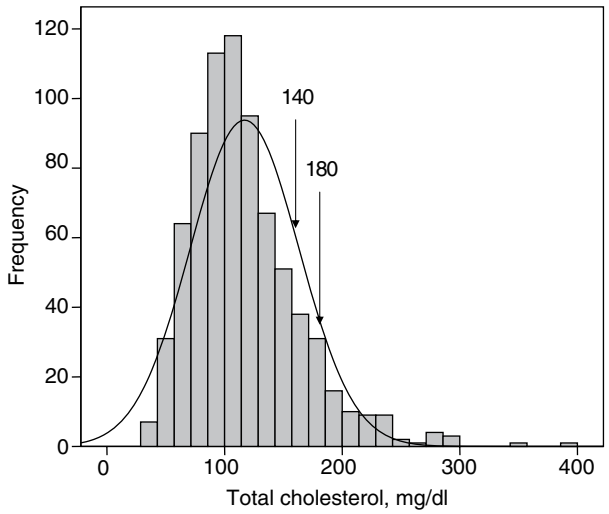

Figure 2 Distribution curve of COL for TP<5.

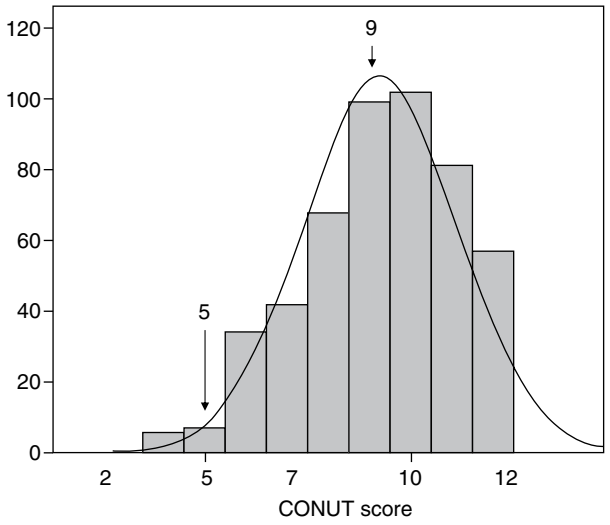

Figure 3 Distribution curve of CONUT scores for TP<5. CONUT indicates Nutritional Control.

Table 5 CONUT score values for TP<5

No.=496* (2004-2006)	CONUT score	TP
Mean	9.25	4.63
Deviation	2.86	0.32
Median	9	4.70

TP, total protein.
*Samples correspond to 451 patients in 15 clinical units.

631 of which (79.9%) were moderate or high MUST risk. Of the F(+), 568 (71.9%) were moderate or high analytical risk, which corresponded with MUST risk results: 421 (74.1%) were at high risk and 147 (25.9%) were at medium risk. Therefore, 100% of F(+) patients with medium or high analytical risk corresponded to medium or high MUST risk (Table 6).

Discussion

Using the value of TP<5 as a tool for filtering patients based on nutritional risk, in the absence of a complete nutritional profile, allows for detecting patients at risk for malnutrition with a high probability of having ALB<3 and a value of COL<140. This, along with the tool being a cheap test that is normally practiced at all levels of health care, justifies its inclusion in the FILNUT with 5 points in its scale, as it can detect medium/high risk of malnutrition.

The FILNUT-scale classifies risk and loses no patients through the CONUT filters, since it similarly quantifies ALB, LYM, and COL. In addition, it can detect others since it does not require the presence of COL or LYM levels for scoring, and when ALB is not present or PRE levels have been recorded that constitute a higher risk score, these levels will be used; finally, if ALB and PRE are missing, then the TP<5 will receive a score of 5. The score assigned to PRE complies with the SENPE-SEDOM consensus evaluation scale for categorising hospital malnutrition and the evidence that, by itself, low PRE values precede a state of malnutrition and indicate risk.

It seems clear that an analytical screening process for risk of malnutrition should be made up of ALB, LYM, and COL, and that this evaluation should be performed as early as possible in the hospitalisation process; however, we believe that the information filter applied to the laboratory database should also have some "fish hooks" such as TP and PRE.

MUST, applied to F(+) patients, contributes little as a risk screening method, but adds clinical data to the analytical data required for a diagnostic orientation to malnutrition. If we add to this an intake test by quartiles of the NRS-2002, we can apply a treatment-oriented algorithm, once knowing the underlying pathology. Since we are discussing a very large number of patients, it would be easier to obtain the collaboration of the nursing staff by performing the test only on F(+) patients at medium or high risk, this being more efficient in terms of time and personnel; even so, the test should also be applied in low or no-risk patients that are drastically thin or have experienced recent significant weight loss.

Finally, we are in accordance with the SENPE malnutrition group in their "Recomendaciones sobre la necesidad de evaluar el riesgo de desnutrición en los pacientes hospitalisados"[30] *(Recommendations on the need for evaluating the risk of malnutrition in hospital patients)*, and we are completely aligned with the need to use screening methods for detecting these patients, whose nutritional state will later be completely evaluated and, if necessary, a plan for nutritional treatment will be established."

Conflict of interests

The authors affirm that they have no conflicts of interests.

Table 6 Relationship between analytical risk from the FILNUT-scale and MUST risk

	FILNUT-scale	MUST	
Risk	Low/medium/high (≥2 TP)	Medium/high (≥1 TP)	
No- patients, %	790	631 (79.9%)	
Risk	Medium/high (≥5 TP)	Medium (1 TP)	High (≥2 TP)
No. patients, %	568	147 (25.9%)	421 (74.1%)

FILNUT indicates Nutrition Filter; MUST, malnutrition universal screening tool; TP, total protein.

References

1. Braunschweig C, Gomez S, Sheean PM. Impact of declines in nutritional status on outcomes in adult patients hospitalized for more than 7 days. J Am Diet Assoc. 2000;100:1316-22.
2. Waitzberg DL, Caiaffa WT, Correira MI. Hospital malnutrition: the Brazilian national survey (IBRANUTRI): a study of 4000 patients. Nutrition. 2001;17:573-80.
3. Wyszynski DF, Perman M, Crivelli A. Prevalence of hospital malnutrition in Argentina: preliminary results of a population-based study. Nutrition. 2003;19:115-9.
4. Kruizenga HM, Wierdsma NJ, Van Bokhorst MA, De van der Schueren, Haollander HJ, Jonkers-Schuitema CF, et al. Screening of nutritional status in The Netherlands. Clin Nutr. 2003;22:147-52.
5. Planas M, Audivert S, Pérez-Portabella C, Burgos R, Puiggròs C, Casanelles JM, et al. Nutricional status among adult patients admitted to an university-affiliated hospital in Spain at the time of genoma. Clin Nutr. 2004;23:1016-24.
6. McWhirter JP, Pennington CR. Incidence and recognition of malnutrition in hospital. BMJ. 1994;308:945-8.
7. Farre-Rovira R, Frasquet Pons L, Ibor Pica JF. Malnutrición hospitalaria: indicadores de evolución postoperatoria. Nutr Hosp. 1998;13:130-7.
8. Kondrup J, Johansen N, Plum LM, Bak L, Larsen IH, Martinsen A, et al. Incidence of nutritional risk and causes of inadequate nutritional care in hospitals. Clin Nutr. 2002;21:461-8.
9. Jeejeebhoy KN. Hospital malnutrition: is a disease or lack of food? Clin Nutr. 2003;22:219-20.
10. Correia MI, Waitzberg DL. The impact of malnutrition on morbidity, mortality, length of stay and costs evaluated through a multivariate model analysis. Clin Nutr. 2003;22:235-9.
11. Reilly JJ, Hull SF, Albert N, Walker A, Bringardener S. Economic impact of malnutrition: a model system for hospitalized patients. J Parenter Enteral Nutr. 1988;12:371-6.
12. Bickford GR, Brugler LJ, Dolsen S, Vickery CE. Nutrition assessment outcomes: a strategy to improve health care. Clin Lab Manage Rev. 1999;13:357-64.
13. Perez de la Cruz A, Lobo Támer G, Orduña Espinosa R, Mellado Pastor C, Aguayo de Hoyos E, Ruiz López MD. Malnutrition in hospitalized patients: prevalence and economic impact. Med Clin (Barc). 2004;10:201-6.
14. Raja R, Lim AV, Lim P, Chan P, Vu CK. Malnutrition screening in hospitalized patients and its implication on reimbursement. Intern Med J. 2004;34:176-81.
15. Elia M, Zellipour L, Stratton RJ. To screen or not to screen for adult malnutrition? Clin Nutr. 2005;24:867-84.
16. Jones JM. The methodology of nutritional screening and assessment tools. J Hum Nutr Diet. 2002;15:59-71.
17. Stratton RJ, Green CJ, Elia M. Disease-related malnutrition: an evidence-based approach to treatment. Oxon, UK: CABI Publishing; 2003. p. 3.
18. Isenring E, Capra S, Bauer J. Nutrition intervention is beneficial in oncology outpatients receiving radiotherapy to the gastrointestinal, head or neck area. Br J Cancer. 2004;91:447-52.
19. Ravasco P, Monterio-Grillo I, Vidal P, Camilo M. Dietary counselling improves patient outcomes: a prospective, randomized, controlled trial in colorectal cancer patients undergoing radiotherapy. J Clin Oncol. 2005;23:1431-8.
20. Stratton RJ, Hackston A, Longmore D, Dixon R, Price S, Stroud M, et al. Malnutrition in hospital outpatients and inpatients: prevalence, concurrent validity and ease of use of the "malnutrition universal screening tool" (MUST) for adults. Br J Nutr. 2004;92:799-808.
21. King CL, Elia M, Stroud MA, Stratton RJ. The predictive validity of the malnutrition universal screening tool (MUST) with regard to mortality and length of stay in elderly patients. Clin Nutr. 2003; 22(Suppl 1):S4.
22. Kondrup J, Rasmussen HH, Hamberg O, Stanga Z; Ad Hoc ESPEN Working Group. Nutritional risk screening (NRS 2002): a new method based on an analysis of controlled clinical trials. Clin Nutr. 2003;22:321-36.
23. Ulíbarri JI, González-Madroño A, González A, Fernández G, Rodríguez F. Nuevo procedimiento para la detección precoz y control de la desnutrición hospitalaria. Nutr Hosp. 2002;17:179-88.
24. Ulibarri JI, González-Madroño A, De Villar NGP, González P, González B, Mancha A, et al. CONUT: a tool for controlling nutritional status. First validation in a hospital population. Nutr Hosp. 2005;20:38-45.
25. Villalobos Gámez JL, García-Almeida JM, Guzmán de Damas JM. Proceso INFORNUT: validación de la fase de filtro –FILNUT– y comparación con otros métodos de detección precoz de desnutrición hospitalaria. Nutr Hosp. 2006;21:477-90.
26. Documento SENPE-SEDOM sobre la codificación de la desnutrición hospitalaria. Available from: http://www.sedom.es/99_pdf/senpe-sedom.pdf
27. García de Lorenzo A, Álvarez J, Calvo M. Conclusiones del II foro de debate SENPE sobre: desnutrición hospitalaria. Nutr Hosp. 2005;20:82-7.
28. Villalobos Gámez JL, Del Río J, García-Almeida JM. Cambios en los índices de complejidad y de utilización de estancias de 2004. Plan de colaboración del equipo de soporte nutricional con servicios de documentación clínica y farmacia. Nutr Hosp. 2006;21(S1):22.
29. Enguix Armada A, Villalobos Gámez JL, Guzmán de Damas M, Costes y beneficios de la Implantación de un perfil nutricional de laboratorio. In: Valoración del estado nutricional por el laboratorio. Cap. 9. Comité de Publicaciones de la Sociedad Española de Bioquímica Clínica y Patología Molecular–SEQC. Ed. Mayo; 2007.
30. Ulibarri JI, Burgos R, Lobo G, Martinez MA, Planas M, Perez de la Cruz A, et al. Componentes grupo trabajo desnutricion SENPE. Recomendaciones sobre la necesidad de evaluar el riesgo de desnutricion en los pacientes hospitalizados. Nutr Hosp. 2009;24(4):461-6.