

A review of the literature related to the role of nutritional supplementation for an enhanced recovery pathway for hip and knee replacement

Branney, J¹, Wainwright TW², Dyall S¹, Middleton RG²

¹Faculty of Health and Social Sciences, Bournemouth University, Bournemouth, UK

²Orthopaedic Research Institute, Bournemouth University, Bournemouth, UK

RCN Society of Orthopaedic and Trauma Nursing International Conference and Exhibition, 8 – 9 September 2016, Cardiff, Wales.

Enhanced Recovery After Surgery (ERAS) pathways for hip and knee replacement have successfully reduced patients' length of stay in hospital through a number of interventions aimed at optimising each stage of the patient journey. Orthopaedic nurses have an important role in promoting the success of ERAS pathways, including the provision of nutritional advice. However, the role of nutrition in such pathways has been limited. Therefore a structured literature review was conducted to determine the evidence base for the inclusion of nutritional supplementation.

Methods

A structured literature search of the following databases – PsycINFO, PsyARTICLES, ScienceDirect, MEDLINE, CINAHL and Cochrane - was conducted on the 29th October 2015. After filtering for duplicates and non-relevance eight randomised clinical trials (RCTs) and 14 observational studies that included follow-up remained.

Results

The results from the eight RCTs are summarised in table 1. In the two studies that included achievement of discharge criteria as an outcome, the addition of supplemental nutrition was not associated with enhanced recovery^{1, 6}. A combination of amino acids might suppress the loss of quadriceps muscle strength after total knee replacement⁸.

Table 1: Summary of randomised clinical trials of nutritional supplementation to enhance recovery after hip or knee replacement surgery

Study number, Author, Year	Study design, setting	Surgery type, Sample	Nutritional intervention	Results
1. Petersen et al (2006)	RCT, Denmark	THR n = 79 (39 female) Mean age 57	Post-op protein-rich drink	Protein-rich drink x3/day as part of a post-operative multimodal optimisation plan did not significantly reduce length of stay, complications or readmission rates compared to conventional care. No blinding.
2. Nygren et al (1999)	RCT, Sweden	THR n = 16	Pre-op carbohydrate loading	Insulin sensitivity was significantly reduced in the placebo group (n=8) but not in the carbohydrate group (n=8). Effect on discharge criteria not reported.
3. Soop et al (2004)	RCT, Sweden	THR n = 14	Pre-op carbohydrate loading	Endogenous glucose release was significantly more attenuated post-op day 3 in the carbohydrate (n=8) versus placebo group (n=6). Effect on discharge criteria not reported.
4. Aronsson et al (2009) [Abstract only]	RCT, Sweden	THR n = 29	Pre-op carbohydrate loading	'Relative increase' in IGF-I bioavailability and non-significant tendency to less fat loss at 2 months in carbohydrate group versus placebo. Effect on discharge criteria not reported.
5. Harsten et al (2012) [Abstract only]	RCT, Sweden	Surgery? n = 60 Age range: 50-80yrs	Pre-op carbohydrate loading	Immediately prior to surgery the carbohydrate group were less hungry and had less nausea than the placebo group; post-op the carbohydrate group reported less pain at 12, 16 and 20h. Effect on discharge criteria not reported.
6. Ljunggren and Hahn (2012)	RCT, Sweden	THR n = 38	Pre-op carbohydrate loading	Although median hospital stay was one day shorter in the carbohydrate group (5 vs 6 days) versus fasting and tap water groups, difference was non-significant.

Table 1: continued

7. Ljunggren et al (2014)	RCT, Sweden	THR n = 23 (16 female) Mean age 68; range 57-76yrs	Pre-op carbohydrate loading	At post-op day two both carbohydrate and placebo groups experienced similar but significant decreases in insulin sensitivity. Effect on discharge criteria not reported.
8. Nishizaki et al (2015)	RCT, Japan	TKR n = 23 (12 female) Mean age 71yrs	Pre- and post-op combination of amino acids	At two weeks post-op the control group (n = 10) experienced a significant decrease in quadriceps strength while the HMB/Arg/Gln supplementation group (n=13) did not. No blinding. Effect on discharge criteria not reported.

THR, total hip replacement; TKR, total knee replacement; RCT, randomised clinical trial; HMB, β-hydroxy-β-methyl butyrate; Arg, L-arginine; Gln, L-glutamine

A number of observational studies (n=14) aimed to identify baseline nutritional parameters that might predict delayed recovery (see table 2). The presence of important confounders in these studies preclude determining whether or not any of these parameters represent legitimate targets for nutritional supplementation that might enhance recovery.

Table 2: Summary of the findings of observational studies of baseline nutritional predictors of delayed recovery after hip or knee replacement surgery

Potential predictor	Reason for delayed recovery		
	Delayed wound healing/infection	Higher risk of post-op complications e.g. infection, organ failure	Worse physical functioning post-op
Low serum albumin	✓ (9) *** (10,11,12)	✓✓ (13,14) ? (15)	N/A
Low serum transferrin	✓ (12) * (11)	N/A	N/A
Low serum zinc	? (16)	N/A	N/A
Low total lymphocyte count	✓ (16) * (10, 12) ? (11)	N/A	N/A
Low vitamin D	N/A	N/A	✓✓✓ (17,18,19) *** (20,21,22)
Smaller anthropometric measures	✓ (10) ? (12)	N/A	N/A

✓ study findings favourable towards predictor; * study findings not favourable towards predictor; ? study findings unclear due to methodological problems. Study number in brackets.

Conclusion

At present the evidence base does not support the use of nutritional supplementation in an ERAS pathway for hip or knee replacement.



www.bournemouth.ac.uk/ori



twainwright@bournemouth.ac.uk



@twainwright

References

1. Petersen, M. K., Madsen, C., Andersen, N. T., Søballe, K., 2006. Efficacy of multimodal optimization of mobilization and nutrition in patients undergoing hip replacement: a randomized clinical trial. *Acta Anaesthesiologica Scandinavica* 50(6), 712-717.
2. Nygren, J., Soop, M., Thorell, A., Sree Nair, K., Ljungqvist, O., 1999. Preoperative oral carbohydrates and postoperative insulin resistance. *Clinical Nutrition* 18, 117-120.
3. Soop, M., Nygren, J., Thorell, A., Weidenhielm, L., Lundberg, M., ;Hammarqvist, F., Ljungqvist, O., 2004. Preoperative oral carbohydrate treatment attenuates endogenous glucose release 3 days after surgery. *Clinical Nutrition* 23, 733-741.
4. Aronsson, A., Al-Ani, N. A., Brismar, K., Hedström, M., 2009. A carbohydrate-rich drink shortly before surgery affected IGF-I bioavailability after a total hip replacement. A double-blind placebo controlled study on 29 patients. *Aging Clinical & Experimental Research* 21(2), 97-101.
5. Harsten, A., Hjartarson, H., Toksvig-Larsen, S., 2012. Total hip arthroplasty and perioperative oral carbohydrate treatment: a randomised, double-blind, controlled trial. *European Journal Of Anaesthesiology* 29(6), 271-274.
6. Ljunggren, S., Hahn, R.G., 2012. Oral nutrition or water loading before hip replacement surgery; a randomized clinical trial. *Trials* 13(1), 97-107.
7. Ljunggren, S., Hahn, R.G., Nystrom, T., 2014. Insulin sensitivity and beta-cell function after carbohydrate oral loading in hip replacement surgery: A double-blind, randomised controlled clinical trial. *Clinical Nutrition* 33(3), 392-398.
8. Nishizaki, K., Ikegami, H., Tanaka, Y., Imai, R., Matsumura, H., 2015. Effects of supplementation with a combination of β -hydroxy- β -methyl butyrate, L-arginine, and L-glutamine on postoperative recovery of quadriceps muscle strength after total knee arthroplasty. *Asia Pacific Journal Of Clinical Nutrition* 24(3), 412-420.
9. Alfargieny, R., Bodalal, Z., Bendaraf, R., El-Fadli, M., Langhi, S., 2015. Nutritional status as a predictive marker for surgical site infection in total joint arthroplasty. *Avicenna Journal of Medicine* 5(4), 117-122.
10. Font-Vizcarra, L., Lozano, L., Ríos, J., Forga, Maria T., Soriano, A., 2011. Preoperative nutritional status and post-operative infection in total knee replacements: a prospective study of 213 patients. *The International Journal Of Artificial Organs* 34(9), 876-881.
11. Marin, L. A., Salido, J. A., López, A., Silva, A., 2002. Preoperative nutritional evaluation as a prognostic tool for wound healing. *Acta Orthopaedica Scandinavica* 73(1), 2-5.
12. Gherini, S., Vaughn, B. K., Lombardi, A. V., Jr, Mallory, T. H., 1993. *Clinical Orthopaedics And Related Research* 293, 188-195.
13. Nelson, C.L., Elkassabany, N.M., Kamath, A.F., Liu J., 2015. Low albumin levels, more than morbid obesity, are associated with complications after TKA. *Clinical Orthopaedics And Related Research* 473(10), 3163-3172.
14. Bohl, D.D., Shen, M.R., Kayupov, E., Della Valle, C.J., 2015. Hypoalbuminemia Independently Predicts Surgical Site Infection, Pneumonia, Length of Stay, and Readmission After Total Joint Arthroplasty. *The Journal of Arthroplasty* 31(1), 15-21.
15. Nicholson, J.A., Dowrick, A.S., Liew, S.M., 2012. Nutritional status and short-term outcome of hip arthroplasty. *Journal Of Orthopaedic Surgery (Hong Kong)* 20(3), 331-335.
16. Zorrilla, P., Gómez, L.A., Salido, J.A., Silva, A., López-Alonso, A., 2006. Low serum zinc level as a predictive factor of delayed wound healing in total hip replacement. *Wound Repair & Regeneration* 14(2), 119-122.
17. Allain, T.J., Beresford, P.A., Newman, J.H., Swinkels, A., 2008. Vitamin D levels in patients undergoing knee arthroplasty: Does vitamin D status effect postoperative outcomes? *e-SPEN, the European e-Journal of Clinical Nutrition and Metabolism* 3, e17-e21.
18. Lavernia, C., Villa, J., Iacobelli, D., Rossi, M., 2014. Vitamin D Insufficiency in Patients With THA: Prevalence and Effects on Outcome. *Clinical Orthopaedics & Related Research* 472(2), 681-686.
19. Nawabi, D.H., Chin, K.F., Keen, R.W., Haddad, F.S., 2010. *Journal of Bone & Joint Surgery, British Volume* 92(4), 496-499.
20. Jansen, J.A. and Haddad, F.S., 2013. High prevalence of vitamin D deficiency in elderly patients with advanced osteoarthritis scheduled for total knee replacement associated with poorer preoperative functional state. *Annals Of The Royal College Of Surgeons Of England* 95(8), 569-572.
21. Unnanuntana, A., Rebolledo, B.J., Gladnick, B., Nguyen, J.T., Sculco, T.P., Cornell, C.N., Lane, J.M., 2012. Does Vitamin D Status Affect the Attainment of In-Hospital Functional Milestones After Total Hip Arthroplasty? *The Journal of Arthroplasty* 27, 482-489.
22. Unnanuntana, A., Saleh, A., Nguyen, J.T., Sculco, T.P., Cornell, C.N., Mancuso, C.A., Lane, J.M., 2013. Low Vitamin D Status Does Not Adversely Affect Short-Term Functional Outcome After Total Hip Arthroplasty. *The Journal of Arthroplasty* 28, 315-322.