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A comparison of two protein supplements on the healing of stage III and IV pressure injuries in enterally fed, ventilator dependent long – term care residents

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**A COMPARISON OF TWO PROTEIN SUPPLEMENTS ON THE
HEALING OF STAGE III AND IV PRESSURE INJURIES IN
ENTERALLY-FED, VENTILATOR-DEPENDENT,
LONG-TERM CARE RESIDENTS**

by

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A Thesis Presented in Partial Fulfillment
of the Requirements for the Degree
Master of Science

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entitled **A comparison of two protein supplements on the healing of stage
III and IV pressure injuries in enterally fed, ventilator dependent long – term care
residents**

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ABSTRACT

The purpose of this study was to evaluate the change in stage III or IV pressure injury size of enterally fed, ventilator dependent, long-term care residents after receiving one of two protein supplements in addition to enteral feeding meeting 100% of calculated needs. The two protein supplements were *Beneprotein*TM (powder) and *Pro T Gold*TM (liquid). The injuries were evaluated for change in size at two weeks and four weeks post initiation of protein supplement. Sixty subjects were reviewed – 30 for each supplement. Subjects included 20 males (33%) and 40 females (67%). The analysis indicated for the total sample, a significant reduction in injury size for those receiving *Beneprotein*TM compared to those receiving *Pro T Gold*TM ($p < 0.05$) after two weeks of supplementation. However, there was no significant difference between the supplement groups after four weeks of continued supplementation ($p = .261$). Injury healing for subjects with an existing comorbidity of diabetes or chronic kidney disease were compared to subjects without these comorbidities. Overall, the comorbidity group experienced greater injury healing compared to the non-comorbidity group after both two weeks ($p < 0.05$) and four weeks of supplementation ($p < 0.05$). This research showed that *Beneprotein*TM provided more rapid wound healing in the first two weeks of supplementation and that the comorbidity group experienced greater benefit from protein supplementation. Further research needs to be conducted with a larger sample size for a longer monitoring time.

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CHAPTER 1

INTRODUCTION

A pressure injury is an injury to the skin, the underlying tissue, or both, usually over a bony prominence that develops because of pressure to the area (Shannon, Brown, & Chakravarthy, 2012). Direct causes of pressure injuries include shear, friction, immobility, and loss of sensation. Indirect causes include poor nutrition, incontinence, aging skin, and mental health conditions. Specific diseases such as diabetes, chronic obstructive pulmonary disease (COPD), renal failure, and heart failure also increase the risk for developing pressure injuries (Mishra & Bhattacharya, 2015). Pressure injuries are classified and defined using a staging system based on the extent of tissue lost and the physical appearance of the injury. These injuries are described as stage I-IV and “unstageable,” which is the most severe level of injury (National Pressure Ulcer Advisory Panel [NPUAP], 2016). In the past, healthcare practitioners believed only those who were bed-bound could develop pressure injuries; however, individuals who are ambulatory can also develop pressure injuries (Wake, 2010). These injuries can develop from a large amount of applied pressure over a brief period of time, or from a small amount of pressure applied over a long period of time (Mishra & Bhattacharya, 2015).

Statement of the Problem

Pressure injuries are common and can be quite costly for patients, their families, and the health care system. The Agency for Healthcare Research and Quality estimates more than 2.5 million U.S. citizens develop pressure injuries annually (Bauer, Rock, Nazall, Jones, & Qu, 2016). The cost of medically managing these injuries is upwards of \$9.1 billion to \$11.6 billion per year. Specifically, treatment for stage III and IV pressure injuries can range from \$5,900 to \$21,410 per injury (Bauer et al., 2016). These high costs are often attributed to skin cleansers, moisturizers, dressing, antibiotics, analgesics, nurse staffing, turning sheet and support devices, wound debridement, and overall inpatient bed-day costs (NPAUP, 2016).

In addition to the direct costs for treating pressure injuries, there are also indirect costs that must be considered. There are more than 17,000 pressure injury-related lawsuits filed annually (Bauer et al., 2016). More important than the monetary costs, the cost to the health of the patient is astounding. Up to 60,000 Americans die each year as a direct complication of a pressure injury. Furthermore, pressure injuries may also negatively affect a person's mental health and increase the burden on family members (Bauer et al., 2016).

One dimension of treatment of pressure injuries is nutrition supplementation (NPAUP, 2016). Various dietary supplements are thought to aid in the healing of injuries. A common supplement administered for injury healing is additional protein. Protein supplementation can be provided orally or administered enterally or parenterally. The source of protein supplementation can vary as well from a liquid to powder supplement (Agrawal & Chauhan, 2012). Although protein supplementation is known to

aid in wound healing, it is not always utilized appropriately. One study analyzed the most frequently conducted nutrition interventions with patients in a hospital setting that had at least one pressure injury. The study found that some of the most frequently utilized interventions were providing support during mealtimes and providing food specifically desired by the patient. Only 25% of these patients with pressure injuries were referred to a dietitian. Furthermore, protein supplements were only provided 8.5% of the time. This study suggested a lack of awareness regarding the importance of nutrition intervention and protein supplementation on the treatment of pressure injuries (Eglseer, Hödl, & Lohrmann, 2018).

The purpose of this study was to evaluate the change in stage III or IV pressure injury size of enterally fed, ventilator-dependent, long-term care residents after receiving one of two protein supplements in addition to enteral feeding meeting 100% of calculated needs. The study took place with residents of The Alden Network; a health care system consisting of long-term care and skilled nursing facilities in the greater Chicago, Illinois area. Subjects were all enterally fed and on a ventilator. The current protocol for administration of protein supplementation for the healing of stage III or IV pressure injuries is to administer three scoops of *Beneprotein*TM each day in addition to the enteral feeding formula. The enteral feeding alone provides 100% of the residents calculated nutrition needs. *Beneprotein*TM is a powdered supplement that contains 6 grams of protein and 25 Calories per 20cc scoop, providing an additional 75 Calories per day and 18 grams of protein per day to the subject. Its ingredients include whey protein isolate and soy lecithin (Nestle Health Science, 2018).

The Alden Network changed its source of protein supplementation to a liquid supplement in July 2018. The liquid supplement, *Pro T Gold™*, is administered in the enteral feedings in a dosage of 30 milliliters once daily. This dosage provides an additional 17.5 grams of protein and 75 Calories. The ingredients of *Pro T Gold™* include water, enzyme-hydrolyzed collagen protein, arginine, citric acid, taurine, tryptophan, histidine, methionine, glutamine, sucralose, benzoate of soda, potassium sorbate, natural flavor, and cysteine (OP2 Labs, 2018). The rationale for changing the source of protein supplementation was financially driven. There is no conclusive evidence indicating whether *Beneprotein™* or *Pro T Gold™* was better for the healing of stage III or IV injuries. This study will help determine if there is a difference in injury healing after administration of either protein supplement. It will also provide health care practitioners with insight on best practices for treating pressure injuries.

Purpose Statement

The purpose of this study was to evaluate the difference in the change in injury size of enterally-fed, ventilator-dependent, long-term care residents with stage III or IV pressure injuries after receiving one of two protein supplements. The protein supplements are *Beneprotein™* (powder) and *Pro T Gold™* (liquid). This study analyzed the effects of a whey protein that was not enriched with amino acids or minerals (*Beneprotein™*), versus a collagen protein that was enriched with amino acids and minerals (*Pro T Gold™*). The pressure injuries were evaluated for change in size at two weeks and four weeks.

Hypotheses

Two hypotheses will be tested:

- (1) There will be no significant difference in changes in injury size of enterally fed ventilator dependent long-term care residents with stage III or IV pressure injuries after two weeks or four weeks of supplementation with three, 20 cc scoops of *Beneprotein*TM versus 30 ml of *Pro T Gold*TM daily.
- (2) There will be no significant difference in changes in injury size of enterally fed ventilator dependent long-term care residents based on presence of comorbidities with stage III or IV pressure injuries after two weeks or four weeks of supplementation with three, 20 cc scoops of *Beneprotein*TM versus 30 ml of *Pro T Gold*TM daily.

Justification

Enteral feedings are a viable option for providing nutrition to patients when they are unable to eat an adequate amount of whole foods (Agrawal & Chauhan, 2012). Often patients who receive enteral feedings are bed bound and/or have limited mobility and have other chronic conditions that impair optimum utilization of nutrition provided. Collectively, these medical conditions may increase an individual's risk for developing pressure injuries (Blumenstein, 2014). Nutrition support should include adequate calories, macronutrients, and micronutrients. However, despite the infusion of adequate nutrition via enteral feeding, the acquisition of pressure injuries in this population is far too common (Barrett, Tuttle, Whalen, Gatchell, & Dawe, 2010). Therefore, it is important to determine which treatments and interventions are effective in preventing and treating pressure injuries in the enteral feeding population.

There are a number of protein supplements offered at different price points available to clinicians to use to promote healing. The choice of supplement(s) should not be compromised by dollars. Non-healing injuries often increase the patient's risk for infection which may require antibiotics and/or may require the surgical interventions of debridement or skin flap to prompt injury repair. These procedures often cause unnecessary pain and discomfort and can be costly.

This study sought to evaluate the impact of two specific protein supplements on pressure injury healing in enterally-fed, ventilator-dependent, long-term care residents. In doing so, this study may help alleviate complications and cost of care.

CHAPTER 2

REVIEW OF LITERATURE

A pressure wound, or injury, is a localized injury on the skin usually over a bony prominence, caused by pressure to the area (Vieira, Sa, Madiera, & Luz, 2014). Often individuals with pressure injuries incur many complications. There are various treatment components provided to help heal pressure injuries. Nutrition interventions have been shown to improve the skin integrity of those with pressure injuries and to facilitate wound healing (Davis, 2015).

Prevalence of Pressure Injuries

It is difficult to quantify the total number of individuals with pressure injuries at any given time because they can occur in patients in hospitals, long-term care facilities, or even in individuals who live independently at home. However, pressure injuries are the second most common billing claim in hospital settings, which is an indication of how often they occur (NPAUP, 2016). Specifically, a study conducted from 2008-2012 found 1.8% of newly admitted hospital patients in the United States had one or more pressure injuries (Bauer et al., 2016).

In the critical care population, rates of pressure injuries are higher than the general population. A study performed in a neurological intensive care unit reported a 12.4% incidence rate of stage II or higher of pressure injuries (Berlowitz, 2013). According to

the International Pressure Ulcer Prevalence surveys, in 2009 rates for facility-acquired pressure injuries in critical care units ranged from 8.8% in cardiac care to 10.3% in surgical intensive care units. Close to one in three of these injuries were stage III or deeper (Berlowitz, 2013). These results illustrate the significant need for improving pressure injury preventative practices in critical care.

Prevalence of Pressure Injuries in Nursing Home Residents

The annual Nursing Home Data Compendium provides data on all Medicare and Medicaid approved nursing homes in the United States (Department of Health and Human Services (DHHS), 2015). This data includes clinical measurements such as the number of residents with pressure injuries, restraints, incontinence, enteral feedings, unintentional weight loss, and use of antipsychotic medications. In 2014, the nationwide prevalence of nursing home residents reported with pressure injuries was 5.1%, which was a slight decrease from 2011 when the prevalence was 5.4%. (DHHS, 2015).

Risk Factors Associated with Developing Pressure Injuries

In an acute-care setting, patients admitted to medical, surgical, orthopedic, oncology, and rehabilitation units are at risk for developing pressure injuries (Demarre et al., 2014). Key risk factors for developing pressure injuries include non-blanchable erythema, urogenital disorders, and elevated body temperature (Kallman & Lindgren, 2014). A study conducted in Saudi Arabia analyzed the risk factors associated with pressure ulcer development in adult intensive care unit patients (Tayyib, Coyer, & Lewis, 2015). The study found age, length of stay, history of cardiovascular disease and kidney disease, infrequent repositioning, time of operation, emergency admission, mechanical

ventilation and lower Braden Scale scores each independently predicted the development of a pressure injury (Tayyib et al., 2015).

A study that took place in medical and surgical wards of a Portuguese hospital analyzed risk factors for pressure injury development during the length of inpatient stay. This study found that out of 153 patients that developed a pressure injury, immobility and inactivity were the two major risk factors for developing the injury (Sardo, Guedes, Alvarelhão, Machado, & Melo, 2018). Additionally, a study that took place in a multivariate setting in New York analyzed predictors of heel pressure injuries. Researchers found seven variables that were significant and independent predictors of developing heel pressure injuries. The variables included diabetes, vascular disease, perfusion issues, impaired nutrition, age, mechanical ventilation, and surgery (Delmore, Ayello, Smith, Rolnitzky, & Chu, 2019).

Another risk factor that may impact an individual's likelihood of developing a pressure injury includes their vitamin/mineral status. A study conducted in surgical and intensive care units in a Boston hospital analyzed whether vitamin D status was a risk factor for hospital-acquired pressure injuries. This study found that a lower vitamin D status at admission was linked to an increased incidence of developing pressure injuries during the length of inpatient stay (Otero et al., 2018).

Areas at High Risk of Developing Pressure Injuries

Pressure injuries tend to develop on areas of the body where there is a bony prominence (Vieira et al., 2014). Bony prominences are areas on the body where the bone is close to the skin. These areas include, but are not limited to the heels, elbows, sacrum, shoulder blades, hips, ears, ankles, and knees (Vieira et al., 2014). The areas that

are under the most pressure on a regular basis are at greatest risk for developing pressure injuries. For individuals who spend a lot of time sitting in a wheelchair, this would include the sacrum, shoulder blades, back of the knee, and feet. For those who are bed bound, susceptible areas may include the ears, hips, sacrum, knees, heels, and ankles (Vieira et al., 2014).

Preventative Treatments/Interventions for Pressure Injuries

In healthcare institutions, preventative wound care treatments are provided to skin areas considered high-risk for developing pressure injuries (Qaseem, Mir, Starkey, & Denberg, 2015). For example, a common preventative strategy is applying a protective dressing to elbows, which are considered a high-risk location due to the proximity of the skin to the bone. (Fiorini, 2012). Other preventative treatments include regular cleaning and protecting the skin areas susceptible to moisture such as the buttocks. The simplest step in preventing a pressure injury is to remove the pressure from the area all together. Regularly turning and repositioning an individual is a major preventative measure all hospitals and long-term care facilities use to prevent the onset of pressure-related injuries (Fiorini, 2012). The American College of Physicians (ACP) recommends that clinicians choose advanced static mattresses or advanced static overlays for patients who are at an increased risk of developing pressure injuries (Qaseem et al., 2015). These tools are recommended because advanced static mattresses and overlays provide a constant level of inflation/support and distribute body weight evenly (Qaseem et al., 2015).

Wound Care: Cleansing

Cleansing is an important first step in preparing the wound for repair (NPUAP, 2014). Regular cleaning and dressing changes are essential for the proper healing of pressure injuries (NPUAP, 2014). Most injuries can be cleansed with potable water or normal saline. An aseptic technique may be considered when the individual has a compromised immune system. In addition, sterile technique is used by wound care nurses to prevent the transfer of bacteria to the wound and minimize pressure exerted on the wound while cleaning and changing the wound dressings (Blunt, 2011).

Debridement

Debridement, or the surgical removal of damaged tissue or foreign objects from a wound, is an effective treatment when a patient's health condition allows it (Gould et al., 2015). Wound debridement should be considered based on the health of the individual, nature of the wound, and the clinical setting (NPUAP, 2014). Like all surgical procedures, there are risks associated with debridement. Pressure injury infections can lead to sepsis (Dana & Bauman, 2014). Sepsis is defined as the presence of harmful bacteria and their toxins, typically transmitted by aseptic procedures and/or tools. In a study designed to investigate the outcomes of debridement among elderly patients (mean age of 73.1 years) with pressure injuries, 83% of the operations were performed on stage IV injuries. Researchers discovered debridement of pressure injuries to be safe and helped to prevent infection, despite the medical co-morbidities that often occur in patients with severe injuries (Choo, Nixon, Nelson, & McGinnis, 2014; Gould et al., 2015).

Factors Affecting Wound Healing

The wound healing process involves four main phases: hemostasis, inflammation, proliferation, and remodeling (Khalil, Cullen, Chambers, Carroll, & Walker, 2015). For complete wound healing to occur, the wound must progress through all four phases in the proper sequence and time frame (Demarre et al., 2014). Many factors can interrupt the progression from one phase to another and impede wound repair. Some of the most researched factors include age, infection, stress, chronic diseases, medications, alcohol use, and nutrition status (Demarre et al., 2014, Khalil et al., 2015).

Age and Wound Healing

Pressure injuries generally affect the elderly population more than other age groups, but it remains unclear why pressure injuries are more common among the elderly (Gould et al., 2015). Wounds in the elderly generally take longer to heal (Gould et al., 2015). Even though researchers and healthcare practitioners understand the healing process is connected with physiologic processes, a clear understanding of the intricacies of the wound healing process and the body's response time to wound care treatments is still unknown (Keyes et al., 2016). Some studies analyzing age-associated changes on healing have been animal trials (Gould et al., 2015; Kim, Mustoe, & Clark, 2015), which poorly translate to the human healing process. However, the research available does suggest pressure injury development is related to skin integrity (Coyer et al., 2015). Researchers report aging causes skin to become dry, rough, and more susceptible to infections (Keyes et al., 2016).

Stress and Wound Healing

Psychological stress can modify wound healing for both pressure injuries and surgical incisions (Carapina, 2015). For instance, greater fear or distress prior to surgery has been reported to lead to poorer outcomes after surgery and a prolonged healing process (El-Mabood & Ali, 2018). In one study, 53 older adults with chronic lower leg wounds were followed to assess psychological impacts on wound healing; those with the highest levels of anxiety and depression were four times more likely to have delayed healing (Carapina, 2015).

Medications and Wound Healing

Drugs such as cytotoxic antineoplastic and immunosuppressive agents, corticosteroids, nonsteroidal anti-inflammatory drugs (NSAIDs), and anticoagulants may delay healing (Bootun, 2012). Immunosuppressive agents are believed to affect healing to such an advanced degree that reduction or avoidance of these drugs is recommended until the wound is completely healed (Bootun, 2012). It has been reported that those taking chronic corticosteroids at least 30 days prior to surgery were two to five times more likely to experience wound complications compared to those who were not taking a corticosteroid at all (Wang, Armstrong, & Armstrong, 2013). There is conflicting evidence regarding the effect of NSAIDs on wound healing. There is insufficient evidence of a detrimental effect of NSAIDs on wound healing when being used at a standard dose for less than two weeks (Chen & Dragoo, 2012).

Comorbidities that Affect Wound Healing

Many individuals who have pressure injuries tend to have a higher incidence of medical conditions. These conditions may include renal failure, pneumonia, or conditions requiring vasoactive drugs (Becker et al., 2017). To facilitate wound healing, the body must have a fully functioning vascular system to deliver oxygen and nutrients to the cells to support energy needs and tissue growth and repair as well as remove toxins and waste products (Wake, 2012). These characteristics are important because the blood system delivers nutrients and oxygen to the tissues and also removes metabolic waste. Therefore, any medical condition that would impair proper function of the organ systems, will inhibit a wound from healing properly (Khalil et al., 2015). There are numerous chronic conditions that may impact wound healing, many of which are common in the adult U.S. population.

Diabetes and Wound Healing

Diabetes mellitus is the number one comorbidity that affects wound healing (Baltzis, Eleftheriadou, & Veves, 2014). It may affect one or more of the four main phases of healing: hemostasis, inflammation, proliferation, and remodeling, all of which are needed for proper skin repair. Patients with diabetes often suffer from impaired wound healing, which can develop into nonhealing diabetic ulcers, facilitate bacterial infections, and necessitate amputation (Baltzis, et al., 2014). Diabetic foot ulcers are one of the most common and serious complications of diabetes. Research has demonstrated impaired biological pathways delay wound healing among those individuals diagnosed with diabetes (Wong et al., 2015). However, much of this research has been conducted using mice and may not be applicable to humans.

Research has found diabetes mellitus disrupts wound repair because of weakened angiogenesis (Lim et al., 2015). One study specifically analyzed the effects of diabetes on the circulation of microRNA and cellular migration and angiogenesis. Inflammation underlying non-healing wounds in patients with diabetes interfered with the body's ability to circulate the microRNA, which in turn delayed the tissue repair process (Dangwal et al., 2015).

Infection and Wound Healing

Complex pressure injuries provide an optimal environment for bacteria growth (Norman et al., 2016). This is especially true for those who experience bowel and bladder incontinence. One recent study with 145 participants found 77% of patients with stage II pressure injuries or higher had *Staphylococcus aureus*, gram-negative bacilli, or both. The researchers suggested that when bacteria multiply, wound healing is delayed, and wounded tissues are further damaged (Norman et al., 2016).

COPD and Wound Healing

The Global Initiative for Obstructive Lung Diseases defines chronic obstructive pulmonary disease (COPD) as a disease "characterized by persistent airflow limitation that is usually progressive" (De-Torres et al., 2016, p. 2). COPD alters the delivery of oxygen and nutrients to tissues. Oxygen and nutrients are necessary for proper healing of pressure, traumatic, or surgical wounds. COPD also provides additional complications of reduced mobility and exercise due to shortness of breath. Because oxygen is required for all stages of wound healing, any condition that is associated with low tissue oxygen tension is a major cause of pressure injuries, including COPD (Mishra & Bhattacharya, 2015).

Spinal Cord Injuries and Wound Healing

A spinal cord injury often causes permanent loss of strength, sensation, and function below the site of the injury (Phillips, Vesmarovich, Hauber, Wiggers, & Egner, 2011). Pressure injuries in the spinal cord injury population often lead to recurrent hospitalizations, multiple surgeries, and/or fatal complications (Kruger, Pires, Ngann, Sterling, & Rubayi, 2013). The incidence of pressure injuries in individuals with spinal cord injuries ranges from 25-66% (Asbeck, 2017). This is attributed mainly to the lack of mobility, however the presence of comorbidities such as diabetes and malnutrition also contribute to the onset of a pressure injury (Kruger et al., 2013).

Pressure Injuries and Mechanical Ventilation

Mechanical ventilation is a risk factor for the development of pressure injuries (Manzano et al., 2011). Patients on mechanical ventilation may need a longer period of time in intensive care units due to the development of a pressure ulcer (Zuo & Meng, 2015). Not only is the hospital length of stay increased, but increased costs are incurred for treatment of pressure injuries in mechanically ventilated patients (Pender & Frazier, 2015). A study conducted in Spain aimed to determine the incidence of pressure ulcer development in ventilated patients in nine medical-surgical ICUs. Of the 299 participants, 16% developed a pressure ulcer of stage II severity or worse (Manazo et al., 2011). A similar study was conducted in an ICU in a Midwestern hospital in the United States. This study found 20% of ventilator dependent patients developed pressure injuries (Pender & Frazier, 2015).

The Impact of Nutrition on Pressure Injuries

Nutrition and hydration play a key role in maintaining and improving skin integrity (Bolton, 2017). However, protocols for treating and managing pressure injuries are primarily guided by outcome studies for treating individuals with injuries due to trauma (Bolton, 2017). Trauma wounds are very different and need to be treated as such (Walker, Metcalf, Parsons, & Bowler, 2015). In addition, most trauma patients are young, healthy, and well-nourished before the injury. On the other hand, chronic wound patients tend to be older, with multiple comorbidities, and are often malnourished (Walker et al., 2015).

The National Pressure Ulcer Long-term Care Study reported poor appetite and unintentional weight loss as risk factors for developing pressure injuries (Horn et al., 2014). Researchers have also reported pre-existing malnutrition to be risk factor for developing undesirable surgery-related or hospital-acquired wounds (Litchford, Dorner, & Posthauer, 2014). Additionally, many acute and chronically ill adults, as well as older adults with pressure injuries experience unintended weight loss after acquiring the wound (Bolton, 2017).

Malnutrition and Pressure Injuries

A study conducted in German hospitals and nursing homes clearly established a significant relationship between the presence of pressure injuries and unintended weight loss (Bolton, 2017). In 2014, the National Pressure Ulcer Consensus Conference faculty supported the relationship between malnutrition and comorbidities and the subsequent increased risk of developing pressure injuries (NPAUP, 2016). In order for the proper cellular responses and homeostatic mechanisms that are necessary for injury healing to

occur, there must be sufficient nutrients available (Pierpont et al., 2014). Those who are malnourished or undernourished may be experiencing a variety of nutritional deficiencies that would alter or delay injury healing (Pierpont et al., 2014).

Low protein levels in the blood caused by malnutrition can also cause edema. The European Pressure Ulcer Advisory Panel stated that skin should be examined in terms of edema because edema may cause pressure injuries (Rafiei, Poursadra, Anvari-Tafti, Dehghani, & Eghbali-Babadi, 2019).

Nutrition Interventions for the Prevention and Treatment of Pressure Injuries

According to a recently updated Cochrane review (Langer & Fink, 2014), there is some evidence that supports medical nutrition therapy being effective for the prevention of pressure injuries (Posthauer, Banks, Dorner, & Schols, 2015). The studies reviewed considered mixed nutritional supplements as an intervention to prevent pressure injuries. The studies had no restrictions on types of patient. The studies reviewed took place in a hospital setting. These mixed supplements included all macronutrients with vitamins and minerals as well. In all studies except for two, the supplements were administered orally alongside a standard hospital diet. Overall findings were that the intervention group had a lower incidence of acquired pressure injuries compared to the control group who did not receive any oral supplementation (Posthauer et al., 2015).

Protein Supplement Use in Treatment of Pressure Injuries

Protein needs are elevated in patients undergoing wound healing, and recommendations are for higher protein intakes to promote pressure ulcer healing and in older persons in general (Bauer et al., 2013). Experts agree estimating protein needs for those with pressure injuries should be at a rate of 1.25-1.5 g protein/kg body weight/day

(Dorner, 2015). For many patients with reduced intake due to medical conditions, protein requirements cannot be met through diet alone. Currently, consensus guidelines recommend a higher protein intake for patients with pressure injuries (Bauer et al., 2013). However, existing evidence does not support a role of multi-ingredient supplements providing protein on pressure ulcer incidence or healing (Langer et al., 2013).

Arginine's Role in Wound Healing

Arginine is a conditionally essential amino acid that is a component of the urea cycle (Alexander & Supp, 2014). Administration of arginine improves blood flow to the limbs, thereby improving the delivery of nutrients to areas in need of repair (Ellinger, 2014). Another important function of arginine is the ability to stimulate the release of growth hormone, as well as insulin-like growth factor I, both of which can advance wound healing (Ellinger, 2014). Additionally, Arginine and its downstream metabolites (e.g., ornithine and citrulline) may be essential to T-cell activation and thus modulate innate and adaptive immunity (Kim, Roszik, Grimm & Ekmekcioglu, 2018).

Research regarding the role of arginine in wound healing has led to the proposal of supplementation of 9 grams of arginine in addition to a typical oral diet for the healing of pressure injuries (Leigh et al., 2012). In a study of 23 inpatients with category II, III and IV pressure injuries randomized to receive daily, for three weeks, a standard hospital diet plus 4.5 or 9g of arginine in the form of a commercial supplement found that providing half of the amount (4.5 g) of the typically prescribed (9 g) arginine provided similar clinical benefits in wound healing. This study showed that providing arginine at a lower dose than is typically prescribed can still improve healing of stage II-IV pressure injuries in an inpatient setting (Leigh et al., 2012).

Glutamine Supplementation and Wound Healing

Glutamine is the most abundant amino acid in the plasma and is a primary metabolic fuel for rapidly proliferating cells. Although utilized by cells that are involved in wound repair, glutamine supplementation has not been consistently shown to benefit wound healing (Chow & Barbul, 2014). Glutamine supplementation decreases infectious complications and protects against inflammatory injury by inducing the expression of heat shock proteins, which provide cellular protection in states of inflammation, injury, and stress. Furthermore, glutamine can modulate and preserve gut function, which is compromised in severe stress (Chow & Barbul, 2014).

A recent study evaluated the wound healing potential of oral glutamine on male Wistar rats. The rats were given 1 g/kg body weight of oral glutamine and were monitored for the healing of a wound on the dorsal side of their bodies. The researchers found oral supplementation of glutamine at a rate of 1 g/kg body weight promoted wound healing when compared to a control group not receiving glutamine. The researchers inferred the reasons for this advanced wound healing was due to glutamine's positive effect on collagen synthesis, wound contraction, and epithelialization (Goswami et al., 2014).

A human study was conducted involving 15 patients with extensive ear, nose, and throat tumor surgery and seven multiple-trauma patients (Farreras et al., 2015). The study investigated the effectiveness of enterally-given glutamine supplementation on immune induction, wound healing, and length of hospital stay. Half of the patients received the glutamine supplemented diet, and the other half received an isocaloric, isonitrogenous diet. Patients fed the glutamine supplemented diet showed significantly

lower ($P = 0.005$) episodes of surgical wound healing complications. The researchers suggested glutamine-infused enteral feeding accelerates wound healing and shortens the length of intensive care unit (ICU) and general ward stays (Farreras et al., 2015).

Zinc Supplementation and Wound Healing

Zinc is a common micronutrient supplemented to patients with pressure injuries because of the role it plays in wound healing (Pierpont et al., 2014). A randomized trial of 60 participants analyzed the effects of zinc on wound healing and metabolic status of patients with diabetic foot ulcers (Momen-Heravi et al., 2017). Participants were randomly assigned to two groups of 30 participants each. One group received oral supplementation of 20 mg zinc daily, the other received a placebo. After the 12-week study, the group receiving zinc was found to have a significantly greater reduction in ulcer size. The researchers determined that zinc is beneficial in reducing wound size when prescribed to diabetic foot ulcer patients for a minimum of 12 weeks (Momen-Heravi et al., 2017).

In another clinical study, zinc was provided orally in 15 mg doses to burn patients (Pierpont et al., 2014). The participants experienced improved outcomes including improved antioxidant status, improved healing time, and decreased mortality rate when compared to those who did not receive oral zinc supplementation (Pierpont et al., 2014).

Vitamin C and Wound Healing

Vitamin C, or ascorbic acid is a cofactor for collagen synthesis and a primary antioxidant (Mohammed et al., 2015). Thus, it appears to aid in wound healing. A study conducted in mice analyzed the effects of vitamin C when administered for 14 days. The study showed vitamin C promoted wound healing while also suppressing the expression

of pro-inflammatory mediators. Vitamin C favorably impacted the resolution of inflammation and tissue remodeling, thereby improving the rate of wound healing (Mohammed et al., 2015).

An additional study analyzed the impact of oral vitamin C on wound healing in mice with diabetes (Chokesuwattanaskul et al., 2018). The mice with diabetes were provided a high dose of vitamin C (1.5 g/l) daily while the control group did not receive any supplementation. At day 14 the data showed oral administration of vitamin C accelerated wound healing. The researchers suggested that oral vitamin C supplementation improves angiogenesis and accelerated diabetic wound healing in the animal model (Chokesuwattanaskul et al., 2018).

Nutrition Support and Wound Healing

There is conflicting and limited evidence regarding the efficacy of nutrition support on the improvement and prevention of pressure injuries (Davis, 2015). A study conducted in 2012 analyzed the effects of feedings via percutaneous endoscopic gastrostomy (PEG) tubes in preventing and helping to heal pressure injuries in nursing home patients with advanced cognitive impairment (Finucane, 2012). The research showed that when nursing home residents were hospitalized and receiving enteral feedings, they were 2.27 times more likely to develop a new pressure ulcer. Additionally, those with existing pressure injuries and PEG tubes were less likely to incur wound healing than those eating by mouth (Finucane, 2012). Essentially, this study determined enteral feedings were not associated with prevention or healing of pressure injuries in nursing home populations.

Additional research has analyzed the effect of arginine-enriched enteral formulas on the healing of pressure injuries in malnourished and non-malnourished patients (McClave, 2017). Research has shown significant improvement in healing of the pressure injuries when comparing arginine-enriched enteral feeding to a standard oral diet. These studies monitored the progress of the wounds between 2-12 weeks. The research concluded that arginine-enriched formula provided positive effects on healing in both malnourished and non-malnourished patients (McClave, 2017).

Additional research has examined the relationship between initiation of enteral nutrition and pressure injuries. In an ICU setting, it has been found that delays in starting and continuing nutrition support may lead to adverse clinical outcomes such as an increase in the risk for developing a pressure injury. Additionally, delaying initiation of enteral support may also prolong the wound healing process of those with existing pressure injuries. This research showed that initiation of enteral nutrition support early on (within 24-48 hours of admission) is essential in preventing and healing pressure injuries (Cox & Rasmussen, 2014).

Summary

Pressure injuries affect over 2.5 million U.S. citizens annually and there seems to be conflicting evidence to strongly support a specific treatment for pressure injury healing. Currently, it appears healthcare practitioners use a variety of approaches to prevent and treat wounds. Still, there is little to acknowledge one approach as better than another. This is in part due to the complexity of the circumstances surrounding the pressure wound such as chronic conditions, medications, etc. (Bauer et al., 2016).

The cost of medically managing these injuries is billions of dollars per year (Bauer et al., 2016). The healthcare expenditures associated with treating and managing pressure injuries puts an additional burden on insurance companies, Medicare and Medicaid, healthcare facilities, family and tax payers. In addition to the medical costs, the mortality of those with pressure injuries is high because the risk for developing infections is higher when compared to those who do not have any pressure injuries (Khor et al., 2014).

There remains gaps in nutrition support research and its effectiveness in improving the outcomes of pressure injuries in the long-term care population. Furthermore, there is even less research available regarding the effects of protein supplementation in addition to enteral nutrition support on pressure injury healing. This study will help to expand the understanding of the role nutrition supplementation plays in the healing of stage III and IV pressure injuries in the long-term care, enterally-fed, ventilator-dependent population.

CHAPTER 3

METHODS

The purpose of this retrospective, medical record study was to evaluate the change in stage III or IV pressure injury size of enterally fed long-term care residents after receiving one of two protein supplements. The two enterally fed protein supplements were *Beneprotein*[™] (powder) and *Pro T Gold*[™] (liquid). The injuries were evaluated for change in size at two weeks and four weeks post initiation of protein supplement.

A retrospective review of resident medical records within The Alden Network was performed. The Alden Network is comprised of over 40 sites in the Chicagoland area, Rockford, Illinois, and southern Wisconsin. Services span the continuum of care from short-term orthopedic recovery and post-acute services, to assisted living and skilled nursing, to independent retirement communities. This study was approved by the Institutional Review Board at The Alden Network and the Louisiana Tech University Human Use Committee prior to data collection (Appendix A).

Subjects

The target population included enterally-fed, ventilator-dependent residents with stage III and IV pressure injuries who received *Beneprotein*[™] or *Pro T Gold*[™] supplements for a minimum of four weeks. The *Beneprotein*[™] group was the first 30

subjects meeting all criteria, working backwards from June 2018. The *Pro T Gold*TM group was the first 30 subjects meeting all criteria, working forwards from September 2018. Subjects included two groups of long-term care residents with stage III and IV pressure injuries on enteral feedings and a ventilator. One group received *Beneprotein*TM supplement and the other group received *Pro T Gold*TM supplement along with their enteral feedings. The previous protocol for protein supplementation for stage III or IV pressure injuries was to administer three 20cc scoops of *Beneprotein*TM each day in addition to the enteral feeding. The enteral feedings alone provided 100% of nutrition needs according to the Ireton-Jones 2002 equation for nutrition needs of ventilator dependent individuals. *Beneprotein*TM is a powdered supplement that was administered as supplemental protein for the purpose of pressure injury healing. *Beneprotein*TM contains 6 grams of protein and 25 Calories per 20cc scoop, which provided 18 grams of protein and 75 Calories per day as a supplement in this study. Its ingredients include whey protein isolate and soy lecithin (Nestle Health Science, 2018). The new protocol was to administer a liquid supplement, *Pro T Gold*TM, in the enteral feedings in a dosage of 30 milliliters once daily. This dosage provided 17.5 grams of protein and 75 Calories. The ingredients in *Pro T Gold*TM include water, enzyme-hydrolyzed collagen protein, arginine, citric acid, taurine, tryptophan, histidine, methionine, glutamine, sucralose, benzoate of soda, potassium sorbate, natural flavor, and cysteine (OP2 Labs, 2018).

In the Alden Network facilities, residents with pressure injuries are monitored by the wound care nurse. At minimum, the wound care nurse measures the size of the wound to track the healing process once a week. This information is recorded in the medical record

Data Collection

After obtaining IRB approval from Louisiana Tech University and the Alden Network, the Health Informatics department at the Alden Network provided de-identified data on the two groups of patients to the researcher. Data obtained included age, gender, diagnosis, location of injury, stage of injury, and size of injury (cubic centimeters) at baseline and at two and four weeks.

Data Analysis

Statistical analysis was conducted using Excel 2010 and SPSS version 25. Non-parametric tests were utilized due to small sample size. A Mann-Whitney test was utilized to analyze the difference in wound size at baseline, two weeks post-supplementation, and four weeks post-supplementation; differences in wound healing between the two different supplements; and to compare overall change in wound size when comparing a comorbidity group versus non-comorbidity group.

CHAPTER 4

RESULTS

A total of 60 subjects were selected to participate in this study; 30 subjects received *Beneprotein*TM and 30 subjects received *Pro T Gold*TM protein supplements in addition to enteral feeding support. Subjects included 20 males (33%) and 40 females (67%). The average age of subjects was 75 (± 12.2). Demographics are further delineated in Table 1.

Nutritional needs of the subjects were determined based on weight, diagnoses, age, and gender utilizing the Ireton-Jones 2002 formula (Cooney & Frankenfield, 2012). The mean calories provided for the *Beneprotein*TM group was 1,813 (± 309). The mean calories provided for the *Pro T Gold*TM group was 1,733 (± 241). Based on guidelines provided by the National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel, and Pan Pacific Pressure Injury Alliance, protein needs were assessed to be 1.25-1.5 g/kg body weight (Posthauer et al., 2015). For the *Beneprotein*TM group, the average amount of protein provided was 1.5 (± 0.04) g/kg body weight, which included protein provided by the enteral feeding and the supplement. For the *Pro T Gold*TM group, the average amount of protein provided was 1.5 (± 0.1) g/kg body weight, which included protein provided by the enteral feeding and the supplement. For each participant 100% of their energy needs, as calculated by the Ireton-Jones 2002 equation for ventilator dependent individuals, were met via enteral feeding. Disease-specific formulas were

provided for those with diabetes or chronic kidney disease. The protein supplements were introduced to subjects with a stage III or stage IV pressure injury upon initial assessment by the dietitian within the first seven days after admission. The subjects had existing stage III or IV pressure injuries upon admission.

The first null hypothesis tested stated: There will be no significant difference in changes in wound size of enterally fed ventilator dependent long-term care residents with stage III or IV pressure injuries after two weeks or four weeks of supplementation with three, 20 cc scoops of *Beneprotein*TM versus 30 ml of *Pro T Gold*TM daily. The analysis indicated there was a significant reduction in wound size for those receiving *Beneprotein*TM ($Mdn = 30$) when compared to those receiving *Pro T Gold*TM ($Mdn = 30$), $W(29) = 311.0$, $Z = -2.094$, $p = .036$ after two weeks of supplementation. However, there was no significant difference between the groups after four weeks of continued supplementation, $W(29) = 374.00$, $Z = -1.124$, $p = .261$. This is outlined further in Table 2.

Table 1
 Characteristics of Enterally-fed, Ventilator-Dependent Subjects with Stage III and IV
 Pressure Injuries (*N*=60)

Variable	<i>n</i> (%)
Age (in years)	
40-50	2 (3.34)
51-60	4 (6.67)
61-70	16 (26.67)
71-80	17 (28.34)
81-90	15 (25)
91+	6 (10)
Gender	
Male	20 (33.3)
Female	40 (66.6)
Injury Stage	
Stage III	28 (46.67)
Stage IV	32 (53.34)
Injury Location	
Sacrum	41 (68.34)
Right buttocks	7 (11.67)
Coccyx	4 (6.67)
Right lateral knee	1 (1.67)
Left hip	1 (1.67)
Left ischium	3 (1.67)
Right gluteal fold	3 (1.67)

Table 2
 Comparison of Injury Size Change Following Two Weeks and Four Weeks of Protein Supplementation by either *Beneprotein*TM or *Pro T Gold*TM ($N=60$)

<i>Beneprotein</i> TM vs. <i>Pro T Gold</i> TM			
Baseline - 2 weeks	$U = 311$	$Z = -2.094$	$p = .036$
Baseline - 4 weeks	$U = 374$	$Z = -1.124$	$p = .261$

*Note:** Reject the null hypothesis ($p, .05$, two-tailed). Significances for U and Z for Independent Sample Mann-Whitney U tests are displayed.

The second null hypothesis stated: There will be no significant difference in change in wound size of enterally-fed, ventilator-dependent, long-term care residents based on presence of comorbidities with stage III or IV pressure injuries after two weeks or four weeks of supplementation with three, 20 cc scoops of *Beneprotein*TM versus 30 ml of *Pro T Gold*TM daily. A Mann-Whitney test was conducted to compare wound size change after two weeks and four weeks of supplementation between those residents with comorbidities and those without comorbidities. Those with comorbidities included residents receiving a specialty enteral formula for chronic kidney disease or diabetes. Those in the non-comorbidity group received standard formulas. The analysis indicated that overall the comorbidity group experienced significantly greater wound healing compared to the non-comorbidity group after both two weeks ($Mdn = 21$), $W(20) = 271.0$, $Z = -2.188$, $p = .029$ and four weeks of supplementation ($Mdn = 21$), $W(20) = 279.0$, $Z = -2.024$, $p = .043$. See Table 3. However, when comparing *Beneprotein*TM and *Pro T Gold*TM on healing of the injuries within the comorbidity group specifically, there

was no significant difference shown in improvement between the two supplements ($Mdn = 21$), $W(20) = 394.50$, $Z = -.268$, $p = .788$.

Table 3
Comparison of Injury Size Change Following Two Weeks and Four Weeks of Protein Supplementation for the Comorbidity Group and Non-Comorbidity Group ($N=60$)

Comorbidity group vs. Non-Comorbidity group			
Baseline - 2 weeks	$U = 271$	$Z = -2.188$	$p = .029$
Baseline - 4 weeks	$U = 279$	$Z = -2.024$	$p = .043$

*Note.** Reject the null hypothesis ($p, .05$, two-tailed). Significances for U and Z for Independent Sample Mann-Whitney U tests are displayed.

Two hypotheses were tested in this study. There was a significant difference seen in pressure injury size with *Beneprotein*TM after two weeks of supplementation, therefore the first hypothesis is rejected. Additionally, the comorbidity group showed a significant improvement in healing after both two weeks and four weeks of supplementation when compared to the non-comorbidity group. Therefore, the second hypothesis is also rejected.

CHAPTER 5

DISCUSSION

The purpose of this study was to evaluate the difference in the change in wound size of enterally fed long-term care residents with stage III or IV pressure injuries after receiving one of two protein supplements. The two protein supplements evaluated were *Beneprotein*TM (powder) and *Pro T Gold*TM (liquid). The injuries were evaluated for change in size from the baseline measurement to two weeks of protein supplementation and from the baseline measurement to four weeks of protein supplementation. A retrospective review of resident medical records within The Alden Network was performed. The target population included enterally-fed, ventilator-dependent residents with stage III and IV pressure injuries who received *Beneprotein*TM or *Pro T Gold*TM for four weeks with 30 subjects in each protein supplement group for comparison.

In order to achieve optimal wound healing, the National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel, and Pan Pacific Pressure Injury Alliance recommend individuals with pressure injuries receive protein providing 1.25-1.5 g/kg body weight and 30-35 kcal/kg body weight per day (Posthauer et al., 2015). In the current study, the *Beneprotein*TM group received an average of 1.5 (± 0.04) g protein/kg body weight and the *Pro T Gold*TM group received an average of 1.5 (± 0.1) g protein/kg body weight.

It was found that there was a significant change of wound size for subjects receiving *Beneprotein*TM when compared to those receiving *Pro T Gold*TM after two weeks of supplementation representing more rapid initial healing. However, there was no significant difference between the groups after four weeks of supplementation. This finding is inconsistent with previous findings showing that amino acid-enriched formulas improved healing versus isocaloric, isonitrogenous formulas (Cereda, E., Klersy, C., Seriola, M., Crespi, A. & D'andrea, F., (2015). The results of previous studies vary from the current study because the current study found improved results within the first two weeks of supplementation with *Beneprotein*TM which is not enriched with amino acids or minerals and is strictly comprised of whey protein and soy lecithin.

The existing literature on the effect of different types of protein supplementation on wound healing for specific comorbidity groups is limited. The current study explored the effects of two supplements on wound healing for comorbidity groups of diabetes and chronic kidney disease. The analysis indicated that regardless of supplement group, there was a significant difference in improvement of pressure injury size for the comorbidity group when compared to the non-comorbidity group after both two weeks and four weeks of supplementation. These results differ from the typical outcomes diabetics experience of delayed wound healing due to elevated blood glucose levels and poor circulation (Collins & Sloan, 2017). However, some studies specifically analyzing nutrition intake and wound healing have found wound improvements in those with diabetes and pressure injuries. A case study out of Japan found that a 58-year-old man with diabetes experienced complete wound healing of a pressure injury to left buttocks after 14 days of protein supplementation (Saino et al., 2018).

Like diabetes, renal impairment has long been known to impair wound healing (Maroz & Simman, 2013). The common risk factors for poor wound healing, generally observed in patients with chronic kidney disease include poorly controlled diabetes mellitus, neuropathy, peripheral vascular disease, chronic venous insufficiency, and aging (Maroz & Simman, 2013). One study analyzed the effect of a supplement combination containing arginine, glutamine and β -hydroxy- β -methylbutyrate, which was given to two elderly patients with renal dysfunction and pressure injuries. A half quantity of the defined dose of the supplement combination, with an enteral nutrition product, was administered to the patients twice a day. This combination improved the wounds with no effect on renal function. This novel finding may provide a nutritional rationale of arginine, glutamine and β -hydroxy- β -methylbutyrate for pressure injuries associated with renal dysfunction (Ogura et al., 2015). The results of this case study are similar to the results of the current study which indicated that those with impaired renal function benefit from protein supplementation for wound healing.

Although these studies vary in type of supplementation, amount of supplementation, and comorbidities of subjects, the previously mentioned studies all show improvement in wound healing when supplementation is provided. It is in consensus of the National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel, and Pan Pacific Pressure Injury Alliance that individuals with pressure injuries receive protein at 1.25-1.5 g/kg body weight (Posthauer et al., 2015). This recommendation is a general guideline for all individuals with a pressure injury. There needs to be more research conducted regarding wound healing in specific comorbidity groups in order to better meet the needs for wound healing at a disease-specific level.

The results of this study are of great benefit to the Alden Network as it provides information regarding the efficacy of the two protein supplements they utilize. The Alden Network will now have its first outcome study directly analyzing the efficacy of both their current protein supplement of choice and their past protein supplement of choice. Data gathered directly from their residents will assist in decision making on protein supplement utilization in the future to best meet the needs of residents with pressure injuries.

There are limited guidelines for how much protein should be provided based on gender, age, comorbidity, or staging of pressure injury. Because there is just one general recommendation given by national and international pressure injury advisory panels, there is room for improvement for more specific guidelines to better meet the needs of those with pressure injuries.

The sample size of this study was relatively small with only 30 subjects in each group, which is a limitation. The length of time of this study was not very long at four weeks total. It would be beneficial to extend the length of observation time, possibly to the total length of time to complete wound closure. Further research needs to be conducted with a greater sample size at a longer monitoring time. More research also needs to be conducted regarding the type and source of protein that should be provided, such as further research into collagen versus whey protein. More research also needs to be conducted at a disease-specific level in order to better determine protein needs for individuals with pressure injuries who also have comorbidities such as diabetes and chronic kidney disease.

APPENDIX A

A-1 LETTER OF APPROVAL FROM HUC

A-2 LETTER OF APPROVAL FROM THE ALDEN NETWORK

A-1 LETTER OF APPROVAL FROM HUC



LOUISIANA TECH
UNIVERSITY

MEMORANDUM

OFFICE OF SPONSORED PROJECTS

TO: Dr. Catherine Fontenot and Ms. Kalli Talaska

FROM: Dr. Richard Kordal, Director of Intellectual Property & Commercialization
(OIPC) *RK*
rkordal@latech.edu

SUBJECT: HUMAN USE COMMITTEE REVIEW

DATE: January 31, 2019

In order to facilitate your project, an EXPEDITED REVIEW has been done for your proposed study entitled:

“A Comparison of Two Different Protein Supplements on the Healing of Stage III and IV Pressure Injuries in Enterally Fed Ventilator Dependent Long-term Care Patients”

HUC 19-070

The proposed study's revised procedures were found to provide reasonable and adequate safeguards against possible risks involving human subjects. The information to be collected may be personal in nature or implication. Therefore, diligent care needs to be taken to protect the privacy of the participants and to assure that the data are kept confidential. Informed consent is a critical part of the research process. The subjects must be informed that their participation is voluntary. It is important that consent materials be presented in a language understandable to every participant. If you have participants in your study whose first language is not English, be sure that informed consent materials are adequately explained or translated. Since your reviewed project appears to do no damage to the participants, the Human Use Committee grants approval of the involvement of human subjects as outlined.

Projects should be renewed annually. *This approval was finalized on January 31, 2019 and this project will need to receive a continuation review by the IRB if the project continues beyond January 31, 2020.* ANY CHANGES to your protocol procedures, including minor changes, should be reported immediately to the IRB for approval before implementation. Projects involving NIH funds require annual education training to be documented. For more information regarding this, contact the Office of Sponsored Projects.

You are requested to maintain written records of your procedures, data collected, and subjects involved. These records will need to be available upon request during the conduct of the study and retained by the university for three years after the conclusion of the study. If changes occur in recruiting of subjects, informed consent process or in your research protocol, or if unanticipated problems should arise it is the Researchers responsibility to notify the Office of Sponsored Projects or IRB in writing. The project should be discontinued until modifications can be reviewed and approved.

Please be aware that you are responsible for reporting any adverse events or unanticipated problems.

A MEMBER OF THE UNIVERSITY OF LOUISIANA SYSTEM

P.O. BOX 3092 • RUSTON, LA 71272 • TEL: (318) 257-5075 • FAX: (318) 257-5079

AN EQUAL OPPORTUNITY UNIVERSITY

A-2 LETTER OF APPROVAL FROM THE ALDEN NETWORK



Ronald C. Benner BSN, MBHA, RN, LNHA
 Vice President of Nursing and Chief Nursing Officer
 The Alden Network
 6200 W. Peterson Ave
 Chicago, Illinois 60642
 April 25, 2018

Graduate Program
 Louisiana Technology University
 305 Wisteria Street,
 Ruston, Louisiana 71272

To Whom It May Concern:

I am writing this letter in support of Ms. Kalli Talaska, RD, LDN, an employee of the Alden Networks: Prism Corporation. It is my understanding that Ms. Talaska is pursuing a Masters of Science in Nutrition and Dietetics.

She has proposed and presented to me a Qualitative Quality Analysis Project that will focus on the effects of liquid protein on healing of stage 3 and 4 pressure ulcers in the long-term enteral feed population. As I find this is in no way a violation of rules associated with human subject matter research and is clearly a beneficial analysis of nutritional stability of our patient population as it relates to promoting healing of integumentary system breakdown, I fully support this project.

I would assume this would be an expedited IRB approval process, we just request a copy of the IRB approval for non-human experimental research to be sent to my email address.

I am more than happy to support Ms. Talaska in the completion of her Capstone Project leading to successful completion of her graduate degree program.

Sincerely,

Ronald C. Benner BSN, MBHA, RN, LNHA
 Vice President of Nursing and Chief Nursing Officer
 The Alden Network
Ronald.benner@thealdennetwork.com
 Phone: 312-623-9792

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