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The Effects of a Synbiotic Diet on Humerus Bone Mineralization and Mechanical Strength in Aging Male Mice

Chandler Allen Sparks, Zachary T Giltner, Cynthia A Blanton, and Annette M Gabaldón

ABSTRACT

Previous studies suggest that probiotic-enhanced diets improve mineral absorption in the large intestine and are thus protective against bone mineral loss. A synbiotic diet, composed of both probiotics and prebiotics, may be even more effective because the bacteria can readily metabolize the fibers of the prebiotics to promote the growth and synthesis of secondary metabolites. We sought to investigate the long-term effects of a synbiotic diet on adult male retired breeder mice. We found that a synbiotic diet does not influence the bone mineralization of the humerus bone. Furthermore, we found that the synbiotic diet does not influence the mechanical strength properties (extrinsic stiffness, ultimate force, fracture force, energy to fracture) of the humerus bone. This study was a subproject of a larger investigation that assessed the influence of the synbiotic diet on femur and tibia bones of the same mice, which revealed similar findings.

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Introduction

A synbiotic diet is composed of both prebiotics and probiotics. Probiotics are live microorganisms that are proposed to confer benefits to the host when consumed, such as the bacterial strains *Lactobacillus acidophilus* and *Lactococcus lactis lactis*. Prebiotics are non-digestible food components that support the growth and activity of bacteria in the gastrointestinal tract. Fructooligosaccharides meet the criteria to be classified as prebiotics. The addition of prebiotics to probiotics, i.e., a synbiotic diet, has been shown to increase the activity of the selected probiotic strains (Schrezenmeir and de Vrese 2001). This increase in activity leads to an increase in the production of short chain fatty acids by the probiotic strains (Scholz-Ahrens & Schrezenmeir 2002). The short chain fatty acids lower the intestinal pH, making minerals more soluble and therefore, more readily absorbed (Scholz-Ahrens & Schrezenmeir 2002). This increased activity of the probiotic strains also leads to an increase in the production of vitamins by the microbes that can be used to maintain bone health (Gibson et al. 1995). Additionally, a synbiotic diet has been shown to promote enterocyte growth, leading to an increased intestinal lining surface area for nutrients, including minerals, to be absorbed; this has been shown in both chickens (Sobolewska et al. 2017) and rats (Campbell et al. 1997).

Previous studies have investigated the effects of a synbiotic diet on bone health using various animal models to determine if mineralization and mechanical strength are enhanced. Scholz-Ahrens et al. 2002 reported that a diet supplemented with prebiotics (oligofructose) prevented the loss of bone mineral content in the femur bones of an ovariectomized female rat model. The effects of probiotic and prebiotic diets in human studies have mixed results, with some indicating no effect on mineral absorption (Ellegård et al. 1997; López-Huertas et al. 2006; Tahiri et al. 2003) and others indicating a positive influence on mineral absorption (Coudray et al. 1997; Van den Heuvel et al. 1999; Van den Heuvel et al. 2000).

Mice are commonly used for bone research because they share basic bone characteristics with humans, have a short gestation period, have high reproductive capabilities, and can be genetically altered (Jilka 2013). For example, age-related BMD loss, as experienced by some older human adults, also occurs in mice (Piemontese et al. 2017). In humans, age-related bone fragility has been associated with alterations in collagen composition (Wang et al. 2002) as well as the size of hydroxyapatite crystals (Cowin 2001). Abnormally thin collagen fibers (Bullough 1981), minerals outside of collagen fibrils (Vetter et al. 1991), altered organization of collagen fibers (Silva et al. 2005), and larger hydroxyapatite crystal size (Cowin 2001) have all been associated with bone fragility. Similar changes in collagen composition (Silva et al. 2005) and hydroxyapatite crystals (Freeman et al. 2001) have been observed in mice, also leading to bone fragility.

Here, we investigated the effects of a long-term synbiotic diet on bone mineralization and strength in adult male retired breeder mice. We previously investigated the influence of a synbiotic diet on two hindlimb bones (femur and tibia), which were collected from the same mice used in the present study, and those results were reported in a thesis project by Choman, 2015. Choman performed three-point bending tests to evaluate bone shaft mechanical strength and used micro-computed tomography to investigate microanatomical properties. Choman's major results showed that the adult male retired breeder mice fed the long-term synbiotic diet for four months did not demonstrate enhanced bone mineralization or mechanical strength. We sought to determine if the major findings from Choman's study, i.e., the absence of a synbiotic diet-induced bone enhancement, could be repeated using a different bone - the humerus bone from the forelimb. Thus, this subproject sought to confirm the findings of Choman, demonstrate that the three-point bending machine was suitable for testing small forelimb bones from mice, and taught undergraduate researchers in the CBASE program at Colorado State University Pueblo research techniques using the DEXA scanner as well as the three-point bending machine.

Methods

Animal Experimental Groups

Thirty 10-month-old male retired breeder mice (HSD: ICR (CD-1), Harlan Laboratories), were randomly divided into three groups (n=10 each): baseline (BSL), control (CON), and synbiotic (SYN). The mice were housed at Idaho State University (ISU) and the experimental protocol was approved by IACUC at Idaho State University, Pocatello. The animals were inspected for health on a daily basis and the study was conducted under veterinary supervision. No health problems developed in response to the diets and all animals completed the study. All mice were fed a standard mouse pelleted diet provided by the vendor. Upon receipt, they

were started on the control diet described in Table 1. The BSL group was kept on the control diet for two weeks before sacrifice. The CON group was fed the control diet for four months and sacrificed at age 14 months. The SYN group fed the control diet enhanced with synbioics for four months and sacrificed also at age 14 months. The BSL group served as a control to identify age-related changes of the bone, as it was sacrificed 3.5 months before the other groups. The CON group served as a control to identify synbiotic diet-induced changes in the bone.

Animal Diets

The control and synbiotic diet compositions are described in Table 1. All mice were fed an isocaloric diet with an energy density of 3800 kilocalories/kg diet. Mice in the BSL and CON group were fed a powdered form of the American Institute of Nutrition (AIN)-93M purified laboratory diet (*Dyets, Inc.*, Bethlehem, PA). Mice in the SYN group received the same diet but enhanced with synbiotics. All diets were prepared in by *Dyets Inc.*, Bethlehem, PA. The diets were in powder form so that food intake could be monitored, so mice were provided with Nalgene chew sticks to maintain dental health. The probiotic strains *Lactobacillus acidophilus* and *Lactococcus lactis lactis* (Nutraceutix, Redmond, Washington) comprised a total of 1% of the synbiotic diet's weight while the prebiotic fructooligosaccharide comprised 3% of the synbiotic diet's weight.

Table 1. Composition of control and synbiotic diets fed to mice.

Ingredient	Control (g / kg)	Synbiotic (g / kg)
Casein	140	140
Cellulose	50	24.5
Choline Bitartrate	2.5	2.5
Cornstarch	720.692	704.692
Fructooligosaccharide (prebiotic)	0	31.5
L-Cystine	1.8	1.8
Probiotic*	0	10
Salt Mix #210050	35	35
Soybean Oil	40	40
t-Butylhydroquinone	0.008	0.008
Vitamin Mix #210025	10	10

* Probiotic strains *Lactobacillus acidophilus* and *Lactococcus lactis lactis*

Bone Dissection

BSL group mice were euthanized at 10 months of age. The right forelimb was carefully removed from the glenoid fossa of the scapula, fixed in formalin, then stored in 70% ethanol and transported to Colorado State University Pueblo. Unintentionally, one left forelimb (rather than right) was removed from one BSL animal (BSL-3) but was kept for analysis. SYN and CON mice were euthanized at 14 months of age and the right forelimb was removed then stored as described for the BSL group. Incidentally, four humerus bones were found to be broken from the dissection (BSL-5, BSL-9, SYN-2, and SYN-3). These bones were used for DEXA scanning but could not be used in the three-point bending tests. The animal group size of $n = 10$ mice per group allows for these incidents in animal studies, as a group size of $n = 7-8$ is appropriate for statistical analysis. Prior to experimentation with the bones, all adhering soft tissue was removed, the humerus was separated from the radius and ulna, and the bones were hydrated in 0.9% saline solution for 24 hours.

Humerus Bone Mineral Density Measurements

Dual energy X-ray absorptiometry (DEXA) scanning is the most commonly used method for measuring the BMD of small animals used in studies of metabolic bone disease (Shi et al. 2016). The method is fast, low-radiation, and relatively inexpensive, making it the method of choice for researchers. DEXA scanners work by sending low-dose X-rays through a sample. The X-rays are absorbed differently by bones and soft tissues. Bone mineral content (BMC) and area of bone are determined by the amount of X-ray energy that is absorbed by the bone (Berger 2002). The denser the bone is, the less X-ray energy will pass through the bone and reach the detector. The values of BMC and area can then be used to determine BMD. The Lunar Piximus II DEXA scanner (Figure 1A) was developed specifically for measuring BMD in small animals and was used in the present study on dissected humeri bones.

All of the bones from each group, with a cotton thread and numbered label tied around each bone for identification, were placed on an artificial tissue block and scanned using the Lunar Piximus II DEXA scanner (Figure 1B). Following scanning, BMC (g), area (cm²), and BMD (g/cm²) values were obtained for individual bones by adjusting the region of interest (ROI) to capture a single bone (Figure 1C-D). The bones were analyzed in duplicate and the values from each measurement were averaged. Quality control testing, as described in the Lunar Piximus II DEXA scanner manual, was performed prior to use of the DEXA scanner to ensure accuracy of the measurements.

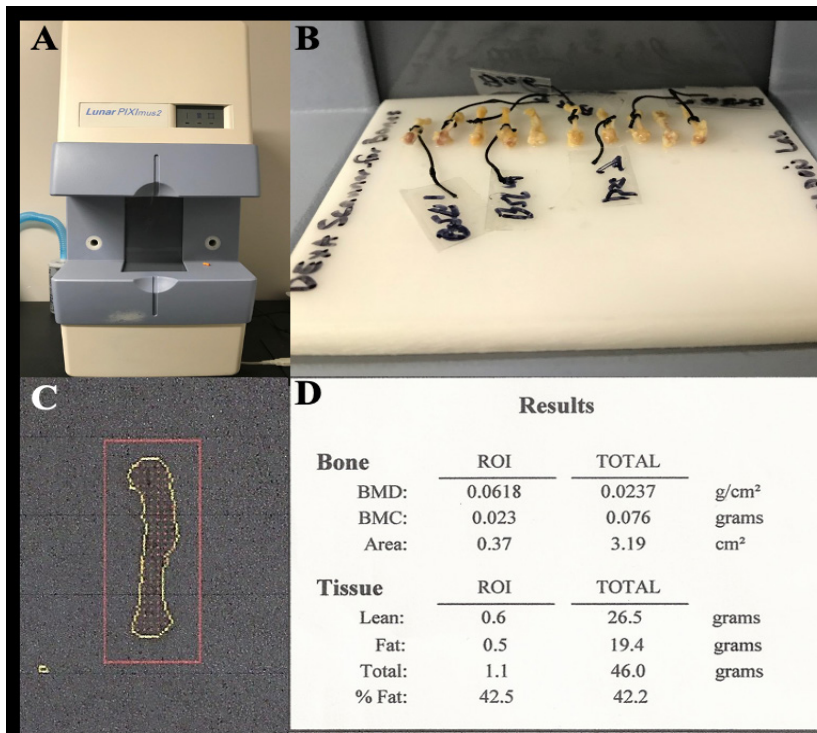


Figure 1. An example of a DEXA scan experiment. (A) The Lunar Piximus II DEXA scanner that was used in the present study. (B) Humeri bones from the BSL group placed on the artificial tissue block with a cotton thread and numbered label tied around them. (C) A single mouse humerus bone captured by the Lunar Piximus II DEXA scanner and enclosed in a ROI (red) for analysis. (D) A data report for the humerus bone shown in panel C.

Humerus Bone Mechanical Strength Testing

Three-point bending is a common method used to determine the mechanical properties of materials, including skeletal long bones, and was the method used here to determine strength properties of mouse humeri bones. Three-point bending is a beam loading method with two fixed supports and a point force in the middle. A three-point bending machine constructed by the Colorado State University Pueblo Department of Engineering and modified for mouse bones was used for mechanical strength testing (Figure 2A). The machine was equipped with a calibrated iLoad Mini force sensor, model MFM-010-050-S (LoadStar Sensors, Fremont, California) with 10 lb capacity and 1.0% accuracy, and a Mitutoyo displacement sensor, model ID-S112EX (Mitutoyo, Aurora, Illinois) with 0.001 mm resolution and 0.00012 inch accuracy. The sensors were connected to the same computer through a 24-bit load cell interface, model DQ-1000 (LoadStar Sensors, Fremont, California). Also, an Exttech Instruments external power source, model 382213 (Exttech Instruments, Nashua, New Hampshire) was connected to the machine to supply power.

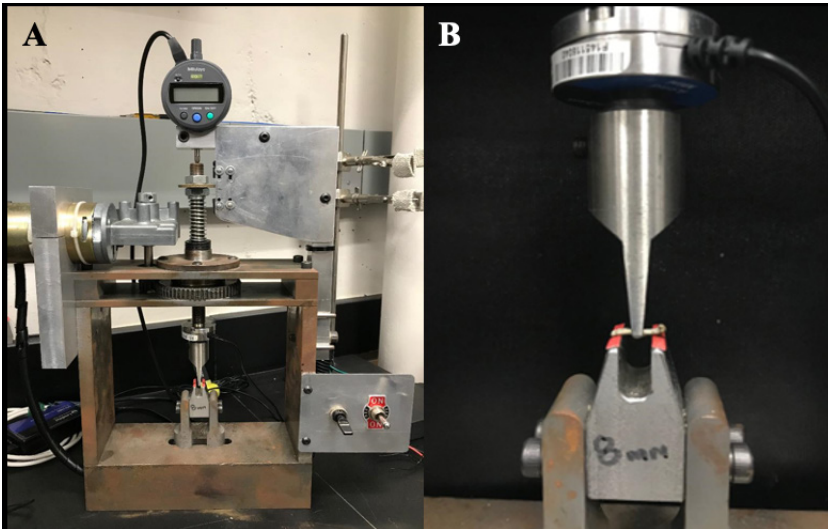


Figure 2. The three-point bending machine utilized in the present study. (A) The three-point bending machine imaged with deflection meter and force sensor. (B) A humerus bone on a two-beam support with crosshead beam at the midshaft.

All humerus bones were placed on a two-beam support with an 8.0 mm width from beam center-to-center (Figure 2B). The posterior surface of the bone was positioned upward, facing the crosshead beam. The top surfaces of the support beams were covered with 80-grit sandpaper to ensure that the bones did not shift during the mechanical strength testing. The crossbeam lowering speed was ensured to be at 1 ± 0.05 mm per minute prior to each day of testing. A preload force of 0.5 – 1.0 N was applied to each bone at the start of each test to help stabilize the bone and ensure a common starting point between different tests. Baseline data, with a preload applied, was collected for 5 seconds prior to further lowering the crosshead beam onto the bone and for 5 seconds following complete fracture of the bone. Data were logged from SensorVue software to Excel in real time and later transferred to Igor Pro 6.36 for analysis of the force-displacement curves. A representative curve analysis procedure is shown in Figure 3. The cursor placements correspond to regions of interest for the various mechanical properties of interest (extrinsic stiffness, ultimate force, fracture force, and energy to fracture). For example, the area under the curve for cursor pair A-B is fracture energy absorbed (N*mm). The slope of the curve between cursor pair C-D is the extrinsic stiffness. These and other relationships are summarized in Table 2. Each force-displacement curve generated by a single humerus bone was analyzed in duplicate and the values from each analysis were averaged.

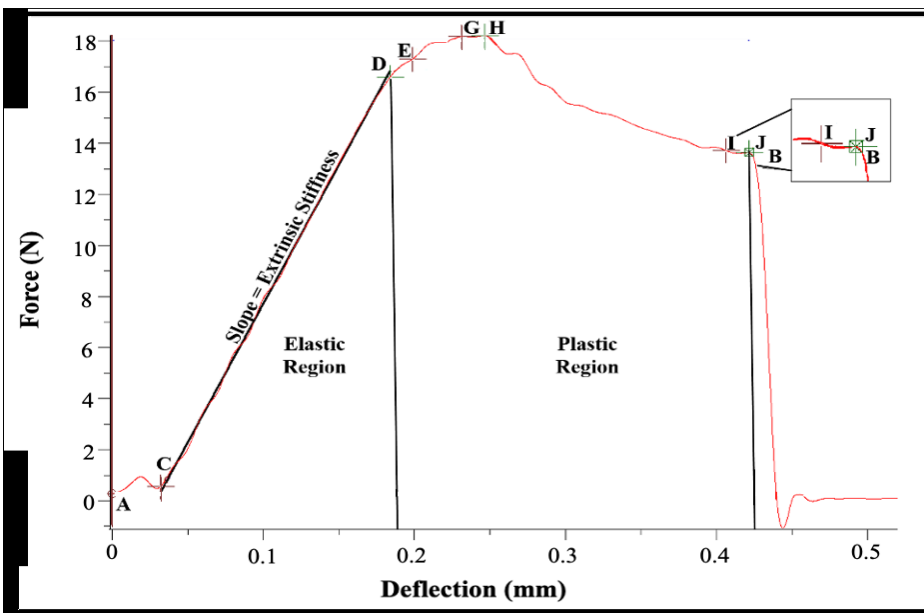


Figure 3. A representative force-deflection curve for a 3-point bending test on a mouse humerus bone. The curves were generated and analyzed using waveform analysis tools in Igor Pro 6.36. Cursors were placed on the force-displacement curve to mark regions of interest. The entire curve is bound by cursors A and B. Cursors C and D identify the linear elastic region, the portion of the curve where the bone will return to its original shape if the force is removed. Cursor E marks the yield point, the point beyond which the bone becomes plastic, where it will not return to its original shape if the force is removed. Cursors G and H bracket the ultimate force. Cursors I and J bracket the fracture force region.

Table 2. Regions defined by cursors and corresponding mechanical properties for force-deflection

Mechanical Property	Cursors	Measurement
Extrinsic stiffness (N/mm)	C-D	Slope
Ultimate force (N)	G-H	Average of points
Fracture force (N)	I-J	Average of points
Fracture energy absorbed (N*mm)	A-B	Area underneath curve

Statistical analyses

Within the general linear, least squares fit model, One-way analysis of variance (ANOVA) was used to analyze main effects of group on DEXA (BMC, bone area, and BMD) and mechanical strength (extrinsic stiffness, ultimate force, fracture force, and energy to fracture) variables. Whenever a significant main effect was found, post-hoc multiple comparisons were performed using Tukey's HSD and Student's t test. Results are reported as means \pm standard error of the mean (SEM) and differences were considered significant at $p < 0.05$. Statistical analyses were performed using JMP Pro®, Version 15.20, SAS Institute Inc., Cary, NC.

Results

Humerus bone mineralization

BMD, BMC, and area for BSL (n=10), CON (n=10), and SYN (n=10) mice were successfully obtained using the DEXA scanner and mean \pm SEM values are shown in Table 3. One-way ANOVA revealed a significant main effect of group on BMC ($p = 0.0075$) and area ($p < 0.0001$). Post-hoc analysis using a student's t-test revealed significant differences in BMC for SYN vs. BSL (10% lower in SYN, $p = 0.0245$) and SYN vs. CON (13% lower in SYN, $p = 0.0025$), but no difference for BSL vs. CON ($p = 0.3492$). Post-hoc analysis using a more rigorous Tukey's test also revealed a significant difference in BMC for SYN vs. CON ($p = 0.0068$) and near significance for SYN vs. BSL ($p = 0.0615$). Similar results were observed for post-hoc comparisons of bone area values which were significantly lower in SYN vs. BSL and CON groups. Specifically, bone area was 10.5% less in SYN vs. BSL (Student's t test, $p < 0.0001$; Tukey's, $p < 0.0001$) and 12% less in SYN vs. CON (Student's t test, $p < 0.0001$; Tukey's, $p < 0.0001$). One-way ANOVA did not reveal a main effect on BMD ($p = 0.7467$), thus all groups had values that were not significantly different.

Table 3. Mouse humerus bone DEXA scanning measurements of BMD, BMC, and bone area.

Group	BMD (g/cm ²)	BMC (g)	Area (cm ²)
BSL, 10 mo	0.05533 \pm 0.00098 A	0.0202 \pm 0.0006A	0.370 \pm 0.00424 A
CON, 14 mo	0.05632 \pm 0.00095 A	0.0210 \pm 0.00062A	0.376 \pm 0.00587 A
SYN, 14 mo	0.05517 \pm 0.00409 A	0.0182 \pm 0.00046B	0.331 \pm 0.00837 B
Main Effect Group, p-Value			
(One-Way ANOVA)	$p = 0.7467$	$p = 0.0075^*$	$p < 0.0001^*$

Values are means \pm SEM. *One-way ANOVAs with post-hoc multiple comparisons shown for Student's t-test. Within a column, values not sharing a letter superscript are significantly different ($p < 0.05$).

Humerus bone mechanical strength properties

From the force-displacement curves generated using three-point bending, intrinsic stiffness, ultimate force, fracture force, and energy to fracture were obtained for BSL (n=8), CON (n=10), and SYN (n=8) mice. The results are summarized in Table 4. One-way ANOVA showed no main effect of group on extrinsic stiffness ($p = 0.2392$), ultimate force ($p = 0.2160$), fracture force ($p = 0.3877$), or energy to fracture ($p = 0.5122$), thus all groups had values that were not significantly different.

Table 4. Average intrinsic stiffness, ultimate force, fracture force, and energy to fracture of mouse humerus bones obtained from three-point bending.

Group	Extrinsic Stiffness (N/mm)	Ultimate Force (N)	Fracture Force (N)	Energy to Fracture (N*mm)
BSL, 10 mo	127.90±33.50	16.28±0.51	16.29±0.55	2.56±0.39
CON, 14 mo	106.53±4.78	18.05±0.80	17.71±0.97	2.53±0.19
SYN, 14 mo	139.99±30.68	17.83±0.69	17.83±0.69	2.75±0.29
Main Effect Group, p-Value				
(One-Way ANOVA)	p = 0.2392	p = 0.2160	p = 0.3877	p = 0.5122

Values are means ± SEM. *One-way ANOVAs showed no main effects of group for any variable.

Discussion

The goal of this study was to determine the effects of a long-term synbiotic diet on skeletal bone mineral density and mechanical strength in adult male retired breeder mice fed the diet from ages 10 to 14 months. We found that the synbiotic diet did not have a significant effect on BMD, which indicates that the diet likely did not influence mineralization in the mice. Mice in the synbiotic diet group did, however, have significantly lower BMC (10-13% less) and bone area (10.5-12% less) compared to mice in the other groups, which suggests that they have moderately smaller humerus bones. Possibly, the synbiotic diet induced microanatomical changes in the bone cortical surface area. This possibility could be determined in future studies using high resolution imaging such as micro-computed tomography. Of the three-point bending test parameters analyzed, ultimate force and fracture force are measures of strength. The finding that the synbiotic diet did not influence either of these two variables thus indicates that it does not influence strength. Furthermore, the synbiotic diet did not influence the humerus bone's extrinsic stiffness or energy to fracture.

The findings of this study are consistent with those of Choman (2015), who analyzed the femur bones from the same mice used in the present study. Choman showed that a synbiotic diet did not provide mechanical strength benefits and was associated with slightly decreased BMD. Choman showed this using a three-point bending machine and micro-computed tomography. It should be noted, however, that there were changes in the geometry of the femur bones in mice fed the synbiotic diet, as analyzed by micro-computed tomography scanning (Choman, 2015). The findings of this study, however, do differ from those of similar studies with different animals. As noted, Scholz-Ahrens et al. have shown positive results of the diet on bone health in rats (Scholz-Ahrens et al. 2002). Some human studies show positive effects of the diet (Coudray et al. 1997; Van den Heuvel et al. 1999; Van den Heuvel et al. 2000) with others showing no effect ((Ellegård et al. 1997; López-Huertas et al. 2006; Tahiri et al. 2003). The mixed results of studies regarding probiotics, prebiotics, and a synbiotic diet in rats, mice, and humans may indicate that the diet has different influences on different species. Future works regarding the variation of bone response to a synbiotic diet between species and individuals will need to be conducted to address this.

The mice used in this study were male albino breeder mice that were purchased at 10 months of age (BSL) and fed the synbiotic or control diet up to 14 months of age (SYN and CON, respectively). Bone mineral properties and bone strength properties can vary depending on the age of the mice with peak bone mass occurring between 4-6 months in most mice strains (Jilka 2013). It should be noted that the typical age of a mature adult mouse is 3-6 months, that the age to be considered middle-aged is 10 months, and that mice begin to show senescence changes at about 18 months of age (Flurkey et al. 2007). Thus, the mice used in this study were past development but not in a senescence stage and can be considered middle-aged. With the exception of BSL-3, humerus bones from the right side of the body were used. It has also been shown by Franco et al. that mouse humerus bones from the left side of the body have greater BMD values than those from the right (Franco et al. 2004). Storage methods have also been shown to have an influence on bone properties. Storage in ethanol, as done in this experiment, has been shown to reduce the elasticity of bone (Sedlin 1965). Genetic influences also play a role in bone phenotype and, therefore, bone properties may vary across mouse strain (Sabsovich et al. 2008). This study only analyzed the influence of the diet on male mice. Glatt et al. have detailed that female mice exhibit more

rapid bone loss than male mice (Glatt et al. 2007). Further research of the diet on female mice may reveal sex-specific influences of the diet. Therefore, the values for bone mineralization parameters as well as bone strength parameters may vary between studies due to age, genetic, sex, and bone handling influences.

We acknowledge that there are factors that prevent direct comparisons of our results with previous studies. Specifically, the humerus bones have been formalin fixed and stored for a long time in 70% alcohol, so the mechanical strength test absolute values cannot be directly compared to freshly dissected bone specimens. However, bone mineralization is well preserved so BMD comparisons can be made. Nevertheless, relative comparisons of values between the three treatment groups described in *Methods* (BSL, CON, SYN) can be made because the bones were stored in the same manner for all three groups and evaluated using the same methods and protocols. Thus, relative influences of the synbiotic diet on BMD and mechanical strength properties of the humerus can be determined.

In conclusion, this study demonstrated no enhancing effects of a long-term synbiotic diet on bone mineralization or mechanical strength in the humerus bones of adult male retired breeder mice. These findings are consistent with those of a similar study on the femur and tibia bones of the same mice (Choman, 2015). Primarily, this study has confirmed the findings of Choman. It should be noted that these findings were confirmed using a different bone (humerus vs. femur & tibia) and slightly different methodology, as Choman used micro-computed tomography to assess mineralization properties whereas a DEXA scanner was used in the present study. Furthermore, it has been demonstrated that the three-point bending machine used in the present study is appropriate for small bones from the forelimbs of mice. This expands the range of experiments that can be carried out using the three-point bending machine that was used in the present study. Lastly, this study has allowed undergraduate researchers to learn as well as develop techniques that can be applied to future projects and taught to other researchers. Regarding the findings of the synbiotic diet on the bone parameters, determining the microstructural bone response to a synbiotic diet using micro-computed tomography or histomorphology methods would facilitate a further understanding of the present findings. Furthermore, experiments investigating different animal models (e.g. female vs. male mice) could be performed to elucidate different effects across different populations.

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References

- Berger, A. (2002). How does it work?: Bone mineral density scans. *Bmj*, 325(7362), 484-484. doi:10.1136/bmj.325.7362.484
- Bullough, P. (1981). The geometry of diarthrodial joints, its physiologic maintenance, and the possible significance of age-related changes in geometry-to-load distribution and the development of osteoarthritis. *Clin Orthop Relat Res*, 61-66.
- Campbell, J. M., Fahey, G. C., & Wolf, B. W. (1997). Selected indigestible Oligosaccharides affect large Bowel Mass, Cecal and FECAL short-chain fatty Acids, pH and microflora in rats. *The Journal of Nutrition*, 127(1), 130-136. doi:10.1093/jn/127.1.130
- Choman, M. (2015). The Effect of a Synbiotic Diet on Bone Structure in Aging Male Mice (Unpublished master's thesis). Department of Biology, Colorado State Univeristy Pueblo.
- Coudray, C., Bellanger, J., Castiglia-Delavaud, C., Rémésy, C., Vermorel, M., & Rayssiguier, Y. (1997). Effect of soluble or partly soluble dietary fibres supplementation on absorption and balance of calcium, magnesium, iron and zinc in healthy young men. *European Journal of Clinical Nutrition*, 51(6), 375-380. doi:10.1038/sj.ejcn.1600417
- Cowin, S. C. (2009). *Bone mechanics handbook*. New York, NY: Informa Healthcare.
- Ellegård, L., Andersson, H., & Bosaeus, I. (1997). Inulin and oligofructose do not influence the absorption of cholesterol, or the excretion of cholesterol, Ca, Mg, Zn, Fe, or bile acids but increases energy excretion in ileostomy subjects. *European Journal of Clinical Nutrition*, 51(1), 1-5. doi:10.1038/sj.ejcn.1600320
- Franco, G. E., Litscher, S. J., O'Neil, T. K., Piette, M., Demant, P., & Blank, R. D. (2004). Dual Energy X Ray Absorptiometry of ex vivo HcB/Dem Mouse Long Bones: Left Are Denser Than Right. *Calcified Tissue International*, 76(1), 26-31. doi:10.1007/s00223-004-0073-5
- Freeman, J., Wopenka, B., Silva, M., & Pasteris, J. (2001). Raman Spectroscopic Detection of Changes in Bioapatite in Mouse Femora as a Function of Age and In Vitro Fluoride Treatment. *Calcified Tissue International*, 68(3), 156-162. doi:10.1007/s002230001206
- Flurkey, K., Curren, J. M., & Harrison, D. (2007). Chapter 20 - Mouse Models in Aging Research. In *The Mouse in Biomedical Research* (2nd ed., pp. 637-672). Cambridge, MA: Academic Press. doi:https://doi.org/10.1016/B978-012369454-6/50074-1
- Gibson, G. R., & Roberfroid, M. B. (1995). Dietary Modulation of the Human Colonic Microbiota: Introducing the Concept of Prebiotics. *The Journal of Nutrition*, 125(6), 1401-1412. doi:10.1093/jn/125.6.1401
- Glatt, V., Canalis, E., Stadmeier, L., & Bouxsein, M. L. (2007). Age-Related Changes in Trabecular Architecture Differ in Female and Male C57BL/6J Mice. *Journal of Bone and Mineral Research*, 22(8), 1197-1207. doi:10.1359/jbmr.070507
- Jakob, F., Seefried, L., & Schwab, M. (2014). Alter und Osteoporose. *Der Internist*, 55(7), 755-761. doi:10.1007/s00108-014-3468-z
- Jilka, R. L. (2013). The Relevance of Mouse Models for Investigating Age-Related Bone Loss in Humans. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, 68(10), 1209-1217. doi:10.1093/gerona/glt046
- López-Huertas, E., Teucher, B., Boza, J. J., Martínez-Férez, A., Majsak-Newman, G., Baró, L., . . . Fairweather-Tait, S. (2006). Absorption of calcium from milks enriched with fructo-oligosaccharides, caseinophosphopeptides, tricalcium phosphate, and milk solids. *The American Journal of Clinical Nutrition*, 83(2), 310-316. doi:10.1093/ajcn/83.2.310
- Sabsovich, I., Clark, J. D., Liao, G., Peltz, G., Lindsey, D. P., Jacobs, C. R., . . . Kingery, W. S. (2008). Bone microstructure and its associated genetic variability in 12 inbred mouse strains: μ CT study and in silico genome scan. *Bone*, 42(2), 439-451. doi:10.1016/j.bone.2007.09.041
- Scholz-Ahrens, K. E., Açil, Y., & Schrezenmeir, J. (2002). Effect of oligofructose or dietary calcium on repeated calcium and phosphorus balances, bone mineralization and trabecular structure in ovariectomized rats. *British Journal of Nutrition*, 88(4), 365-377. doi:10.1079/bjn2002661

- Scholz-Ahrens, K., & Schrezenmeir, J. (2002). Inulin, oligofructose and mineral metabolism — experimental data and mechanism. *British Journal of Nutrition*, 87(6), 179-186. doi:10.1079/bjnbjn/2002535
- Schrezenmeir, J., & Vrese, M. D. (2001). Probiotics, prebiotics, and synbiotics—approaching a definition. *The American Journal of Clinical Nutrition*, 73(2). doi:10.1093/ajcn/73.2.361s
- Sedlin, E. D. (1965). A Rheologic Model for Cortical Bone: A Study of the Physical Properties of Human Femoral Samples. *Acta Orthopaedica Scandinavica*, 36(Sup83), 1-77. doi:10.3109/ort.1965.36.suppl-83.01
- Shi, J., Lee, S., Uyeda, M., Tanjaya, J., Kim, J. K., Pan, H. C., . . . Soo, C. (2016). Guidelines for Dual Energy X-Ray Absorptiometry Analysis of Trabecular Bone-Rich Regions in Mice: Improved Precision, Accuracy, and Sensitivity for Assessing Longitudinal Bone Changes. *Tissue Engineering Part C: Methods*, 22(5), 451-463. doi:10.1089/ten.tec.2015.0383
- Silva, M. J., Brodt, M. D., Wopenka, B., Thomopoulos, S., Williams, D., Wassen, M. H., . . . Bank, R. A. (2005). Decreased Collagen Organization and Content Are Associated With Reduced Strength of Demineralized and Intact Bone in the SAMP6 Mouse. *Journal of Bone and Mineral Research*, 21(1), 78-88. doi:10.1359/jbmr.050909
- Sobolewska, A., Bogucka, J., Dankowiakowska, A., Elminowska-Wenda, G., Stadnicka, K., & Bednarczyk, M. (2017). The impact of synbiotic administration through in ovo technology on the microstructure of a broiler chicken small intestine tissue on the 1st and 42nd day of rearing. *Journal of Animal Science and Biotechnology*, 8(1). doi:10.1186/s40104-017-0193-1
- Tahiri, M., Tressol, J. C., Arnaud, J., Bornet, F. R., Bouteloup-Demange, C., Feillet-Coudray, C., . . . Coudray, C. (2003). Effect of short-chain fructooligosaccharides on intestinal calcium absorption and calcium status in postmenopausal women: A stable-isotope study. *The American Journal of Clinical Nutrition*, 77(2), 449-457. doi:10.1093/ajcn/77.2.449
- Van den Heuvel, E. G., Muys, T., Van Dokkum, W., & Schaafsma, G. (1999). Oligofructose stimulates calcium absorption in adolescents. *The American Journal of Clinical Nutrition*, 69(3), 544-548. doi:10.1093/ajcn/69.3.544
- Van den Heuvel, E. G., Schoterman, M. H., & Muijs, T. (2000). Transgalactooligosaccharides Stimulate Calcium Absorption in Postmenopausal Women. *The Journal of Nutrition*, 130(12), 2938-2942. doi:10.1093/jn/130.12.2938
- Vetter, U., Fisher, L., Mintz, K., Kopp, J., Tuross, N., Termine, J., & Robey, P. G. (2009). Osteogenesis imperfecta: Changes in noncollagenous proteins in bone. *Journal of Bone and Mineral Research*, 6(5), 501-505. doi:10.1002/jbmr.5650060512
- Wang, X., Shen, X., Li, X., & Agrawal, C. M. (2002). Age-related changes in the collagen network and toughness of bone. *Bone*, 31(1), 1-7. doi:10.1016/s8756-3282(01)00697-4
- Warming, L., Hassager, C., & Christiansen, C. (2002). Changes in Bone Mineral Density with Age in Men and Women: A Longitudinal Study. *Osteoporosis International*, 13(2), 105-112. doi:10.1007/s001980200001

Figures

Figure 1. An example of a DEXA scan experiment. (A) The Lunar Piximus II DEXA scanner that was used in the present study. (B) Humerus bones from the BSL group placed on the artificial tissue block with a cotton thread and numbered label tied around them. (C) A single mouse humerus bone captured by the Lunar Piximus II DEXA scanner and enclosed in a ROI (red) for analysis. (D) A data report for the humerus bone shown in panel C.

Figure 2. The three-point bending machine utilized in the present study. (A) The three-point bending machine imaged with deflection meter and force sensor. (B) A humerus bone on a two-beam support with crosshead beam at the midshaft.

Figure 3. A representative force-deflection curve for a 3-point bending test on a mouse humerus bone. The curves were generated and analyzed using waveform analysis tools in Igor Pro 6.36. Cursor pairs were placed on the force-displacement curve to mark regions of interest. The entire curve is bound by cursors A and B. Cursors C and D identify the linear elastic region, the portion of the curve where the bone will return to its original shape if the force is removed. Cursor E marks the yield point, the point beyond which the bone becomes plastic, where it will not return to its original shape if the force is removed. Cursors G and H bracket the ultimate force. Cursors I and J bracket the fracture force region.

Mindfulness-Based Stress Reduction Practice; Reduced Levels of Perceived Stress and Increased Mindful Awareness in an Adult Population

Makenna Linn, Carol Foust, Jude LaFollette, Bethany Kies-Bolema

ABSTRACT

Research on Mindfulness-Based Stress Reduction (MBSR) programs has demonstrated promising results in both clinical and non-clinical settings. The purpose of this study was to determine the impact of an MBSR-based program on the perceived stress and five facets of mindful awareness in an adult population. A pre-post study design was used to analyze changes in participant's perceived stress and mindful awareness after participating in an eight-week program based on MBSR in a community-based setting. Data was collected using The Perceived Stress Scale and Five Facet Mindfulness Questionnaires. A paired two sample t-test was applied to determine if any significance difference from pre to post was apparent. The study found a significant increase in each individual mindfulness facet, the total FFMQ score, as well as a significant decrease in perceived stress. These findings align with previous MBSR studies.

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Introduction

Mindfulness has become widely known for the many benefits it provides. The definition of mindfulness provided by Jon Kabat-Zinn, the founder of Mindfulness-Based Stress Reduction (MBSR), is the “awareness that arises through paying attention, on purpose, in the present moment, non-judgmentally” (Mindful Staff, 2016). Kabat-Zinn first introduced mindfulness meditation practices in a clinical setting as a form of treatment for patients with chronic pain. He observed a considerable decrease in chronic pain reported among the patients as well as a decrease in negative mood states including depression, anxiety, tension, fatigue and confusion (Kabat-Zinn, 1982). Since Kabat-Zinn’s seminal research, positive outcomes have been noted in MBSR programs and other meditation practices and therapies conducted in both clinical and non-clinical settings. Mindfulness has been defined as having different facets. One of the most common measures of mindfulness is the Five Facet Mindfulness Inventory (Baer, Smith, Hopkins, Krietemeyer & Toney, 2006). The five facets include observing, describing, acting with awareness, acting in non-judge, and non-reactivity.

MBSR is traditionally a group-based eight-week program that focuses on the cultivation of mindfulness through four formal practices: body scan, sitting meditation, purposeful movement meditation, and Hatha yoga, which focuses on breathing (Kabat-Zinn, 1982, 1990; Grossman, Schmidt, & Walach, 2004; Chiesa & Serretti, 2009). A study conducted by Carmody and Baer (2008) specifically researched the significance of the home practice component within the MBSR program and found that time spent engaging in home practice of formal meditation exercises was significantly related to improvement in most facets of mindfulness and several measures of symptoms and well-being. This finding emphasizes the importance of practicing mindfulness on an individual basis, which is encouraged throughout an MBSR program. Moreover, full or half day intensive mindfulness retreats are an integral part of MBSR, as studies show a positive effect in pre-to-post self-reported mindfulness when comparing mindfulness-based interventions with and without intensive mindfulness retreats (Visted, Vøllestad, Nielsen, & Nielsen, 2015).

MBSR has been studied in a number of clinical settings (e.g., medical outpatient treatment centers, dermatology clinics, pain centers, and psychiatric treatment centers), and in such settings the benefits of mindfulness training on physical and mental health are numerous. Results suggest that the training is correlated with many benefits including reduced drug use relapse prevention (Bowen et al., 2014), decreased HIV pathogenesis (Cole, Korin, Fahey, & Zack, 1998), improving the treatment of psoriasis (Kabat-Zinn et al., 1998), and managing chronic pain (Kabat-Zinn, 1982; Kabat-Zinn, Lipworth, Burney & Sellers, 1987; McCracken & Thompson, 2009; Schutze, R., Röss, Preece, & Schutze, M., 2010). The impacts on mental health are even more widely noted in the literature and include: use in the treatment of eating disorders (Lavender, Jardin & Anderson, 2009), decreasing anxiety (Arch & Craske, 2010; Miller, Fletcher, & Kabat-Zinn, 1995; Fang et al., 2010; Rasmussen & Pidgeon, 2010), reducing the risk for relapse in major depression (Teasdale et al., 2000; Creswell & Lindsay, 2014). There have also been reports of MBSR training resulting in significant improvements in obsessive compulsive symptoms, somatization, interpersonal sensitivity, psychoticism, and paranoid ideation (Chiesa & Serretti, 2009). A three-year post-intervention follow-up study was conducted with 18 of the original 22 medical patients who engaged in an eight-week, outpatient mindfulness-based stress reduction intervention program for anxiety and depression. The research showed a significant decrease in anxiety after the intervention, as well as at three months and three years compared with others that met intervention criteria for the original study but did not participate in the program (Miller et al., 1995). This suggests that mindfulness training can provide not only short-term benefits, but lasting effects as well (Kabat-Zinn et al., 1987; Carlson, Ursuliak, Goodey, Angen, & Speca, 2001).

Mindfulness meditation practices have benefited people with a number of mental illnesses, symptoms, disorders, and brain function. Three different studies used an eight-week, group-based mindfulness training to analyze the effects of mindfulness on brain function. All of the studies found that those who participated in MBSR experienced an increase in left hemisphere activation. The participants also had an increase in gray matter concentration in the left side of the brain, which involves learning and memory processes, emotion regulation, self-referential processing, and perspective taking (Davidson et al., 2003; Holzel, Carmody, & Evan et al., 2010; Holzel, Carmody, & Vangel et al., 2010). Furthermore, results from two studies indicated an increase in immune function as a result from mindfulness training (Davidson et al., 2003; Fang et al., 2010). Overall, there is a strong body of evidence demonstrating the positive effect mindfulness has on brain function and immune function.

When reviewing the results of non-clinical settings, such as in schools, community-based programs and spiritual/religious settings, mindfulness meditation practices have shown to be beneficial. Mindfulness has been observed to increase quality

of life and well-being (Baer et al., 2006; Fang et al., 2010; Baer, Carmody, & Hunsinger, 2012; Cresswell & Lindsay, 2014; Paiva et al., 2015) and has been found to significantly increase empathy baseline and effectively improve self-compassion levels (Chiesa et al., 2009). Benefits have also included a significant reduction in perceived stress levels and an increased ability to cope (Carlson, Speca, Patel, & Goodey, 2003; Shapiro, Astin, Bishop, & Cordova, 2005). Moreover, studies have shown improvements in the quality of sleep, reduction in sleep disturbances, mood disturbance and fatigue in cancer patients (Carlson et al., 2001; Carlson & Garland, 2005; Andersen et al., 2013). The purpose of this study was to determine if an eight-week MBSR course held in a group setting for community members once a week with home practice would result in any significant outcome on 1) participants' perceived levels of stress and 2) participants' scores on the five facets of mindfulness.

Methods

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. IRB approval was reviewed and approved by the Colorado State University Pueblo Human Subjects Committee. The study did not receive external funding.

Study Participants

Participants in this study live in Pueblo, Colorado which is a moderate size of approximately 150,000 people in Southern Colorado. The 117 participants enrolled in an eight-week program titled "Mindful Me" that used a Mindfulness-Based Stress Reduction curriculum. The participants were 99% women with an average age of 54 years old and were hospital employees, patients, and community members. The participants met once a week for 2 hours in a community room at a local hospital and were asked to complete home practice. The program was facilitated by a chaplain trained in MBSR. Participation in the MBSR program was voluntary. Study participants were recruited through advertisements in a local newspaper, flyers and brochures about the program posted throughout the hospital, presentations given at various health conferences, groups, and luncheons in the local community.

Orientation Session

After participants voluntarily signed up for the program, they attended an informational session about a week before the classes started, which provided detailed information regarding the program, the expectations for the program, the potential risks and benefits of participation, and a brief, one-on-one meeting with program staff. During the orientation, participants were informed of potential risks and performed a self-assessment of their physical, mental and emotional health in order to participate. If they decided to participate, they signed an informed consent agreement and completed a participant inventory, which included demographic and contact information.

During the informational session, participants completed necessary paperwork including an intake form with a self-assessment to determine physical, mental and emotional readiness to complete the course. The self-assessment was developed from materials produced by the Center for Mindfulness. The Five Facet Mindfulness Questionnaire (FFMQ) and the Perceived Stress Scale (PSS) were also administered before and after participating in the program.

Five Facet Mindfulness Questionnaire

The FFMQ has been validated and showed reliable results in research for the structure of mindfulness (Tran, et al., 2013) and a factor analysis confirmed and tested a consistent reliability model (Christopher, et al., (2012). Construct mindfulness was confirmed through regression and mediation analysis showing the facets were significantly related to meditation experience and to psychological symptoms and well-being (Baer, et al. 2008).

The FFMQ incorporates the facets that are most strongly correlated to the related psychological constructs. The five mindfulness facets are: observe, describe, act with awareness, non-judge, and non-react. Each of these proves useful in understanding the relationships between mindfulness and other conceptually related variables. For example, the describe facet is the most important in understanding mindfulness' relationships with emotional intelligence and alexithymia (lacking the words to describe one's feelings to others), whereas the act with awareness facet is central to its relationships with dissociation and absent-mindedness (Muller, 2000; Baer et. al, 2006). In this way, the FFMQ has shown to be promising in predicting psychological symptoms. Santorelli and Kabat-Zinn (2002) stated that the ability to describe mindfulness in readily accessible language is essential for providers of MBSR. Understanding empirically supported facets of mindfulness may provide suggestions to clinicians about how to describe it to

clients. The FFMQ can also be a helpful tool for those teaching MBSR, not only in using it as an evaluative assessment, but also as a way to describe the dimensions of mindfulness.

Perceived Stress Scale

The 10-item PSS is an easy-to-use assessment with acceptable psychometrics (Lee, 2012). Khalili et al. (2017) tested the validity and reliability of the PSS and found the validity and scale content were remarkable. The KMO coefficient was .82 and Bartlett's Test was significant, as well as a Cronbach's Alpha of .72. The repeated measure demonstrated a high reliability of .93. Antanes et al., (2015) found the PSS was used in research to validate mindfulness using the perceived stress score to develop the awareness of mindfulness in occurrence with stress and how it is perceived while in a mindful state.

The Perceived Stress Scale is a measure of the degree to which situations in one's life are appraised as stressful. The PSS looks at the subjective measures of stress, which in certain cases is more beneficial than objective measures of stress because people actively interact with their environment and perceive potentially threatening or challenging events in regard to their available coping resources. Therefore, the causal event is cognitively mediated by the emotional response to the objective event, and not the objective event itself. Despite the fact that the PSS is a short, 10 question survey, it has substantial test reliability and validity as well as a strong correlation between various behavioral criteria associated with stress (Cohen et al, 1983). It is also noteworthy to mention that the relationship between validity and the PSS is not affected by age or gender. The PSS can be used to discern whether or not perceived stress is a risk factor for clinical psychiatric disorders, as well as analyze the relationship between the objective stressor and the individual's response (Cohen et. al, 1983).

The Intervention: Mindful Me

The intervention used in this study, Mindful Me, followed the MBSR curriculum created by Jon Kabat-Zinn and Saki Santorelli (Kabet-Zinn, Santorielli, Meleo-Meyer, & Koerbel, 2017). Participants attended a two-hour session for 8-weeks, and completed one 4.5-hour retreat in a community room at a local hospital. They also completed home practice during the eight-week session. The facilitator of the intervention was the Lead Chaplain at the hospital who had received training through the Center for Mindfulness in teaching mindfulness-based stress reduction. Each week, the two-hour face to face sessions incorporated mindfulness themes along with formal meditation practices (e.g., body scan, sitting meditation, awareness of breath meditation, purposeful walking, standing yoga and lying down yoga) and informal meditation practices based on MBSR materials (Kabet-Zinn, et al., 2017). Handouts were provided at the end of each session detailing the home practice for each week. Participants were given CD's of guided meditations to encourage and enable them to practice formal meditation on their own throughout the remainder of the week. The 4.5-hour group silent retreat took place at the same site as the weekly sessions between weeks six and seven. Its purpose was to provide an opportunity to firmly and effectively establish the use of MBSR skills and prepare participants to utilize these methods beyond the conclusion of the program.

After receiving instruction and skill development in each two-hour session, the participants were provided with CD's that had verbal instruction for practice of the learned skills, e.g., guided body scan, awareness of breath, lying down yoga and extended sitting meditation, to practice at home along with a handout detailing what the home practice consisted of and supplemental information that aligned with the theme for each week. The majority of the supplemental information came from Jon Kabat-Zinn's book "Full Catastrophe Living" and "Coming to Our Senses: Healing Ourselves and the World Through Mindfulness" and focused on meditation, the seven attitudes of mindfulness practice, the stress-reaction cycle, and how to cope with stress - responding versus reacting (Kabat-Zinn, 1990; Kabat-Zinn, 2005).

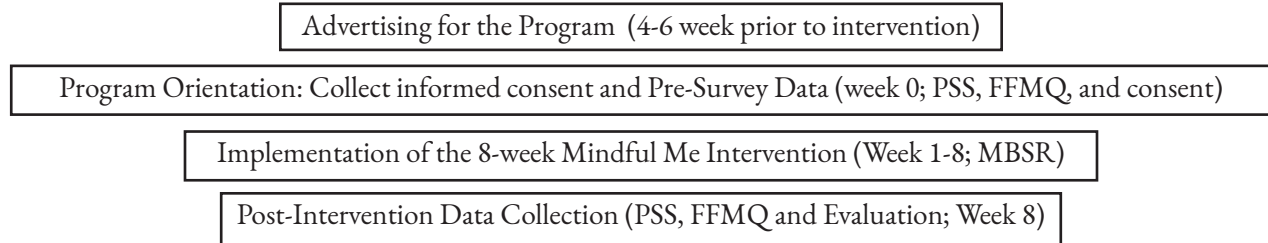
Survey Data Collection

In addition to the inventory completed during the orientation, the participants were also asked to complete the Perceived Stress Scale survey and a Five Facet Mindfulness Questionnaire. The assessments were administered via paper and pencil during the group orientation, held one week prior to the intervention, and again during the last session of the intervention. Both of these tools have been validated as effective and reliable measures to evaluate the different facets of mindfulness and an individual's perceived stress levels (Baer et al., 2006; Cohen, Kamarck, & Mermelstein, 1983).

At the last session of the program, the program leaders administered a paper and pencil post Perceived Stress Scale survey and post Five Facet Mindfulness Questionnaire, as well as a program evaluation to the participants. The pre and post-program PSS and

FFMQ were collected and entered into an Excel spreadsheet. The names of participants were used only to match the surveys and demographic information and were kept confidential.

Timeline for the Program Implementation



Statistical Analysis

The pre and post program data was compared for differences by applying a paired t-test in Excel to determine if any significant change had occurred. The PSS pre and post program data was collected for two years with a total of 112 surveys analyzed. The FFQ was not administered until the second year of the program with a total of 42 questionnaires analyzed.

The qualitative outcomes of the program were collected in a post survey design with 112 surveys completed for analysis. The comments were analyzed by utilizing text analysis to determine key words and phrases. The key words and phrases were categorized into patterns through structural and pattern coding. Finally, through triangulation, common themes were developed.

Results

Post program PSS total scores of the participants were compared with the pre-program PSS total scores using a paired two sample t-test. The result showed significant reduction in perceived stress ($n=133$, pre-program mean= 16.24, post-program mean= 13.86, $p=8.84E-07$). Post program FFQ individual scores (observe, describe, act aware, non-judge, non-react) and total scores of the participants were compared with the corresponding preprogram FFQ scores using a paired two sample t-test. Results found significant improvements for all five facet areas as well as the total as noted in Table 1.

Table 1.
Pre- and Post-MBSR Program Measures: Perceived Stress Survey and Five Facet Questionnaire

<i>Measure</i>	<i>Pre-MBSR mean (SD)</i>	<i>Post-MBSR mean (SD)</i>	<i>p-value</i>
PSS*	16.24 (49.00)	13.86 (32.30)	0.000000884
Observe Facet*	27.74 (34.53)	30.98 (13.94)	0.0000295
Describe Facet*	28.48 (33.30)	30.16 (48.28)	0.012
Act Aware Facet*	23.31 (35.19)	26.41 (19.98)	0.000088
Non-judge Facet*	26.78 (45.96)	30.28 (26.67)	0.000063
Non-react Facet*	21.05 (24.81)	23.85 (15.53)	0.0000128
FFMQ Total*	127.36 (53.25)	141.67 (31.01)	0.00000349

Paired T-tests performed for each measure

*denoted statistical significant difference pre to post at the .05 alpha level.

The qualitative data collected included feedback from the at home mindfulness practice. Mindfulness home practice included guided body scan, awareness of breath, lying down yoga and extended sitting meditation, which was supplemented with information that aligned with the theme for each week. Home practice was completed by 97% of the participants who filled out the post evaluation, with 20% practicing one to two days a week, 55% practicing three to four days a week, and 25% practicing five to seven days a week.

The average amount of time spent each day was varied with 30% of the participants reporting practicing five to 10 minutes, 57% reported practicing 20-30 minutes and 13% reported practicing for more than 30 minutes each day. The in-home practice had the participants practice their learned skill from the in-class instruction. Post survey comments from the participants in the program from the at-home practice resulted in five common themes.

Analysis resulted in five common themes from the evaluation comments concerning the value of the class; an increase in mindfulness skill development such as meditation, body scan and yoga, an increase in personal awareness and control, an increase in self-acceptance and compassion, awareness of the value of practicing in a group setting, and the value of a safe space with an effective facilitator. Representative participant comments are displayed below.

“I have gained and refreshed several areas of my mind. I feel at any moment I have the resources to calm, breathe and become present to what’s now us. Reviewing a situation over in mind, I am more tolerant in a heated discussion and allow others’ views to be heard. At times improved concentration. In addition, my yoga practice is more mindful and in moment.”

“I have learned that it is important for me to slow down and notice what is happening in all aspects of my life so that my relationships with my family and my body are much calmer and gentler. I’ve learned to recognize what stress feels like in my body and breathe my way out of it. I’ve learned to be kinder and to appreciate my body and my mind and my life more.”

“The calmness, skill and guidance of the facilitator helped me be more aware. The class was very effective in teaching skills and the facilitator was well trained and compassionate.”

“That there is peace and strength within me that I can access at any time; fear and anxiety accomplish nothing but only closes me off to potential solutions and creativity.”

“The confidence of the peaceful setting facilitated the practice and the tools to use in my own time and pace. It made it possible to improve my skills in my own time and way.”

“My thoughts are not always reality; thought come and go don’t have to be permanent. If you eat mindfully some foods don’t taste as good as you think they do - so why eat them? I learned to be more compassionate to myself.”

“Learning that I can first STOP and take hold of my emotions to stressors, sit and breathe. Kind of like it’s ok to check out. Being more aware of my pace and slowing day is VERY DIFFICULT for me including the need to take care of me.”

“It helped me control my ingrained anxieties caused by a lifelong pattern of running on “adrenalin.” I am now better at being “aware.”

Discussion

The results demonstrate differences in participants’ pre and post 8-week MBSR program scores on the Perceived Stress Survey and the Five Facet Mindfulness Questionnaire. Hypothesized significant increases in all mindfulness facets and a significant decrease in perceived stress levels were accepted and confirmed. The standard deviation scores decreased for most of the factors between the pre-test and post-test scores. This may have been caused by cognitive learning experienced through the program, or through the mental and physical awareness outcomes experienced by the participants throughout the process. The participants may have become more familiar with the terminology or expectancy bias could be a factor. The fact that the participants’ perceived stress levels decreased significantly upholds the assertion that Mindfulness-based Stress Reduction training positively affects a person’s ability to handle stress, which aligns with previous studies (Carlson et al., 2003; Shapiro et al., 2005; Andersen et al., 2013).

Overall, the FFMQ results demonstrated a significant increase in participants’ use of the constructs of mindfulness. As the facets were identified individually, interesting differences were evident. The act with awareness facet had the strongest increase compared to the other facets. This could potentially be due to the meditation and other mindfulness practices implemented, which focused on bringing awareness to one’s surroundings and actions. There were comments on the participant’s evaluations which stated that before they took the course they were functioning on ‘autopilot,’ but after taking the course they have become more aware of their lives and their actions.

One participant stated on their evaluation in response to the question “What have you learned, if anything, from this program?”:

“(I) think before I speak in difficult situations, I notice things more clearly, not to judge myself or others, and I am aware of how my body is involved with stress.”

The non-judge facet showed the second strongest increase. There is a major emphasis on not judging thoughts, feelings, or emotions during the MBSR program, which could account for the high score.

The observe facet was the third strongest facet increase in the results. This could potentially be due to participants learning and strengthening the practice of mindful awareness, which invites participants to observe what they were eating (mindful eating practice), observe bodily sensations, emotions and thoughts (body scan, mindful walking, sitting meditation and yoga) and emphasizing mindful communication. Non-react facet was the fourth strongest facet. Another emphasis in the program is to not have an immediate reaction, but to employ the STOP practice (stop, take a breath, observe, proceed). Another participant stated that they learned:

“The ability to slow down, to put things in their proper perspective. to self-regulate. When I do the mindfulness techniques everything is more manageable. As a therapist, I’ve heard mindfulness frequently but never had a full understanding of what it is, how to practice it properly and know it benefits the body. Now I know and will utilize it in my practice.”

The describe facet was the least significant of the five facets, but still had a significance of 0.012 compared to an alpha level of 0.05. The describe facet had the highest pre-MBSR score, which suggests that the majority of participants were already relatively higher functioning in this facet compared to the other four, therefore leaving less room for improvement.

Conclusion and Recommendations

In conclusion, the participants who attended an eight-week MBSR course had a significant decrease in their perceived levels of stress and a significant increase in their scores on the five facets of mindfulness. The participants also reported an increase in mindfulness skills, an increase in personal awareness and control, and an increase in self-acceptance and compassion, which they were able to apply in their home practice and everyday life. The findings of this study align with findings in previous studies (Carlson et al., 2003; Shapiro et al., 2005; Andersen et al., 2013), which further suggests the positive effects that mindfulness has on the mind and body, and that MBSR may be useful as an intervention technique for combating stress.

The lack of a control group was a limitation for this study. Future studies could implement the use of a control group in order to compare PSS and FFMQ scores before and after the program, as well as employ a blind study to help avoid the placebo effect. Follow-up long-term evaluation could also be performed to determine the persistence of the skill development and increase in mindfulness and perceived level of stress.

Compliance with Ethical Standards:

Funding: This study did not receive external funding.

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. IRB approval was reviewed and approved by the Colorado State University Human Subjects Committee.

Informed consent: Informed consent was obtained from all individual participants included in the study.

References

- Andersen, S. R., Würtzen, H., Steding-Jessen, M., Christensen, J., Andersen, K. K., Flyger, H., Mitchelmore, Johansen, C., & Dalton, S. O. (2013). Effect of mindfulness-based stress reduction on sleep quality: Results of a randomized trial among Danish breast cancer patients. *Acta Oncologica*, 52(2), 336-344.
- Atanes, A. C., Andreoni, S., Hirayama, M. S., Montero-Marin, J., Barros, V. V., Ronzani, T. M., ... & Demarzo, M. M. (2015). Mindfulness, perceived stress, and subjective well-being: a correlational study in primary care health professionals. *BMC complementary and alternative medicine*, 15(1), 303.
- Arch, J. J., & Craske, M. G. (2010) Laboratory stressors in clinically anxious and non-anxious individuals: the moderating role of mindfulness. *Behavior research and therapy*, 48(6), 495-505.
- Baer, R. A., Carmody, J., & Hunsinger, M. (2012). Weekly change in mindfulness and perceived stress in a mindfulness-based stress reduction program. *Journal of Clinical Psychology*, 68(7), 755–765.
- Baer, R. A., Smith, G. T., Hopkins, J., Krietemeyer, J., & Toney, L. (2006). Using self-report assessment methods to explore facets of mindfulness. *Assessment*, 13(1), 27– 45.
- Baer, R. A., Smith, G. T., Lykins, E., Botton, D., Krietemeyer, J., Sauer, S., Walsh, E., Duggan, D., & Williams, J. M. (2008). Construct validity of the five facet mindfulness questionnaire in meditation and nonmeditating samples. *Assessment*, 15(3), 329-342.
- Bowen, S., Witkiewitz, K., Clifasefi, S.L., Grow, J., Chawla, N, Hsu, S.H., Carroll, H.A., Harrop, E., Collins, S.E., Lustyk, M.K., & Larimer, M.E. (2014). Relative efficacy of mindfulness-based relapse prevention, standard relapse prevention, and treatment as usual for substance use disorders: a randomized clinical trial, *Journal of American Medical Association Psychiatry*, (5),547-56.
- Carlson, L. E., & Garland, S. N. (2005). Impact of mindfulness-based stress reduction (MBSR) on sleep, mood, stress and fatigue symptoms in cancer outpatients. *International Journal of Behavioral Medicine*, 12(4), 278-285.
- Carlson, L. E., Speca, M., Patel, K. D., & Goodey, E. (2003). Mindfulness based stress reduction in relation to quality of life, mood, symptoms of stress, and immune parameters in breast and prostate cancer outpatients. *Psychosomatic Medicine*, 65(4), 571–581.
- Carlson, L.E., Ursuliak, Z., Goodey, E., Angen, M., & Speca, M. (2001). The effects of a mindfulness meditation-based stress reduction program on mood and symptoms of stress in cancer outpatients: 6-months follow-up. *Support Care Cancer*, 9, 112–23.
- Carmody, J., & Baer, R. A. (2008). Relationships between mindfulness practice and levels of mindfulness, medical and psychological symptoms and well-being in a mindfulness-based stress reduction program. *Journal of Behavioral Medicine*, 1, 23-33.
- Chiesa, A., & Serretti, A. (2009). Mindfulness-based stress reduction for stress management in healthy people: A review and meta-analysis. *Journal of Alternative and Complementary Medicine*, 15(5), 593-600.

- Christopher, M., Neuser, N., Michael, P., & Baitmangalkar, A. (2012). Exploring the psychometric properties of the Five Facet Mindfulness Questionnaire. *Mindfulness*, 3(2), 124-131.
- Creswell, D. J., & Lindsay, E. K. (2014). How does mindfulness training affect health? A mindfulness stress buffering account. Carnegie Mellon University, *Current Directions in Psychological Science*, 1-7.
- Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior*, 24, 385-396.
- Cole, S. W., Korin, Y. D., Fahey, J. L., & Zack, J. A. (1998). Norepinephrine accelerates HIV replication via protein kinase A-dependent effects on cytokine production. *The Journal of Immunology*, 161, 610–616.
- Davidson, R. J., Kabat-Zinn, J., Schumacher, J., Rosenkranz, M., Muller, D., Santorelli, S. F., Urbanowski, F., Harrington, A., Bonus, K., & Sheridan, J. F. (2003). Alterations in brain and immune function produced by mindfulness meditation. *Psychosomatic Medicine*, 65(4), 564-570.
- Fang, C. Y., Reibel, D. K., Longacre, M. L., Rosenzweig, S., Campbell, D. E., & Douglas, S. D. (2010). Enhanced psychosocial well-being following participation in a mindfulness-based stress reduction program is associated with increased natural killer cell activity. *Journal of Alternative & Complementary Medicine*, 16(5), 531-538.
- Grossman, P., Schmidt, L. N., & Walach, H. (2004). Mindfulness-based stress reduction and health benefits: A meta-analysis. *Journal of Psychosomatic Research*. 57(1), Pages 35–43.
- Holzel, B. K., Carmody, J., Vangel, M., Congleton, C., Yerramsetti, S. M., Gard, T. & Lazar, S. W. (2010). Mindfulness practice leads to increases in regional brain gray matter density. *American Journal of Psychiatry Residents*, 191(1), 36-43.
- Holzel, B. K., Carmody, J., Evans, K. C., Hoge, E. A., Dusek, J. A., Morgan, L., Pitman, R. K., & Lazar, S. W. (2010). Stress reduction correlates with structural changes in the amygdala. *Social Cognitive and Affective Neuroscience* 5(1), 11-17.
- Kabat-Zinn, J. (1982). An outpatient program in behavioral medicine for chronic pain patients based on the practice of mindfulness meditation: Theoretical considerations and preliminary results. *General Hospital Psychiatry*, 4, 33–47.
- Kabat-Zinn, J. (1990). *Full catastrophe living: Using the wisdom of your mind and body to face stress, pain, and illness*. New York, NY: Delacorte.
- Kabat-Zinn, J. (2005). *Coming to our senses: Healing ourselves and the world through mindfulness*. New Your, NY: Hyperion.
- Kabat-Zinn, J., Lipworth L., Burney R., & Sellers W. (1987). Four-year follow-up of a meditation-based program for the self-regulation of chronic pain: treatment outcomes and compliance. *Clinical Journal of Pain*, 3(1), 60.
- Kabet-Zinn, J., Santorielli, S., Meleo-Meyer, F., & Koerbel, L. (2017). *Mindfulness-based stress reduction authorized curriculum guide*. University of Massachusetts Center for Mindfulness in Medicine, Health Care and Society.

- Kabat-Zinn, J., Wheeler, E., Light, T., Skillings, A., Scharf, M. J., Cropley, T.G., Hosmer, D., & Bernhard, J.D. (1998). Influence of a mindfulness meditation-based stress reduction intervention on rates of skin clearing in patients with moderate to severe psoriasis undergoing photo therapy (UVB) and photochemotherapy (PUVA). *Psychosomatic Medicine*, 60(5), 625-632.
- Khalili, R., Sirati, N., Ebadi, A., Tavallai, A., & Habibi, M. (2017). Validity and reliability of the Cohen 10-item Perceived Stress Scale in patients with chronic headache. *Asian Journal of Psychiatry*, 4(26), 136-140.
- Lavender, J. M., Jardin, B. F., & Anderson, D. A. (2009). Bulimic symptoms in undergraduate men and women: Contributions of mindfulness and thought suppression. *Eating Behaviors*, 10(4), 228-231.
- Lee, E. (2012). Review of the psychometric evidence of the Perceived Stress Scale. *Asian Nursing Research*, 6(4), 121-127.
- Miller, J.J., Fletcher, K., & Kabat-Zinn, J. (1995). Three-year follow-up and clinical implications of a mindfulness meditation-based stress reduction intervention in the treatment of anxiety disorders *General Hospital Psychiatry*, 17(3), 192–200.
- Mindful Staff (2016). Jon Kabat-Zinn: Defining Mindfulness. *Mindful: taking the time that matters*. Retrieved from: <http://www.mindful.org/jon-kabat-zinn-defining-mindfulness/>
- McCracken, L., & Thompson, M. (2009). Components of mindfulness in patients with chronic pain. *Journal of Psychopathology and Behavioral Assessment*, 31(2), 75-82.
- Muller, R.J. (2000). When a patient has no story to tell: alexithymia. *Psychiatric Times: UBM Medica*, LLC.
- Paiva, S. C., Nery, S. F., Magalhães, E. B., Couto, B. M., Amaral, C. V., Campos, F. F., & Reis, F. M. (2015). Impact of a short-term, mindfulness-based stress reduction program on the well-being of infertile women: a mixed-method study. *Journal of Endometriosis & Pelvic Pain Disorders*, 7(4), 136-140.
- Rasmussen, M. K., & Pidgeon, A. M. (2010). The direct and indirect benefits of dispositional mindfulness on self-esteem and social anxiety. *Anxiety, Stress & Coping*, 24(2), 227-233.
- Santorelli, S., & Kabat-Zinn, J. (2002). *Mindfulness-based stress reduction professional training: MBSR curriculum guide and supporting materials*. Worcester: University of Massachusetts Medical School.
- Shapiro, S. L., Astin, J. A., Bishop, S. R., & Cordova, M. (2005). Mindfulness-Based Stress Reduction for Health Care Professionals: Results from a Randomized Trial. *International Journal of Stress Management*, 12(2), 164–176.
- Schutze, R. R., Preece, M., & Schutze M. (2010). Low mindfulness predicts pain catastrophizing in a fear-avoidance model of chronic pain. *Pain*, 148(1), 120-127.
- Teasdale, J. D., Segal, Z. V., Mark, J., Ridgeway, V. A., Soulsby, J. M., & Lau, M. A. (2000). Prevention of relapse/recurrence in major depression by mindfulness-based cognitive therapy. *Journal of Consulting and Clinical Psychology*, 68, 615–623.

- Tran, U. S., Glück, T. M., & Nader, I. W. (2013). Investigating the Five Facet Mindfulness Questionnaire (FFMQ): Construction of a short form and evidence of a two-factor higher order structure of mindfulness. *Journal of Clinical Psychology, 69*(9), 951-965.
- Visted, E., Vollestad, J., Nielsen, M. B., & Nielsen, G. H. (2015). The impact of group-based mindfulness training on self-reported mindfulness: A systematic review and meta-analysis. *Mindfulness, 6*(3), 501-522.

Peace Education as a Post-Conflict Reconciliation Method: The Case of Bosnia and Rwanda and the Importance of State Development

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ABSTRACT

Peace education is a tool of reconciliation that governments can use after civil conflict. This paper will focus on reconciliation, methods of reconciliation, and the role education plays in conflict resolution. Then, this paper will introduce the case studies of Rwanda and Bosnia, that experienced a genocide in the 1990s, and how they have dealt with reconciliation through peace education programs. After that, the paper will focus on the circumstances that led to the peace education programs in Rwanda and Bosnia to be more or less successful in reaching their society. It will find that the development of the country has a bigger influence on peace education than literature portrays. Without sufficient funding for schools and access to learning material, efforts of the government can only reach small parts of the population. Because of their development, Bosnia has a way better chance at implementing a successful peace education program that reaches more people than Rwanda.

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Introduction:

Reconciliation and education after a conflict occurs is the most important part in conflict resolutions. Especially in genocides or other traumatizing events, the time period after the initial conflict is resolved is the most critical. States need to invest all their efforts into educating their population about the conflict and resolving traumas and grievances for the likelihood of conflict to decrease. The pattern of the ‘conflict trap’ is an observation that civil conflict seems to reoccur and trap societies in that circle of conflict. Reconciliation addresses one of the reasons for conflict to reemerge and is a commonly used tool in international relations. This tool becomes especially important in civil conflicts because the populations are so heavily involved. After years of war between neighbors and violence based on ethnic, religious, or economic differences, it can be impossible for societies to function in an orderly fashion. Just because the actual fighting has ended does not mean that the societies are at peace within themselves, and that is where reconciliation matters. Educating the younger population about the history of genocide and civil conflict within their country is one of the most important tools of reconciliation.

This paper will compare the genocides of Rwanda and Bosnia, in particular how the governments approached the reconciliation process with peace education after the conflict ended. These two devastating genocides both happened around the same time period and both countries have dealt with reconciliation within their society differently. Particularly because the population was so heavily involved in both cases the process of reuniting the society was a centerpiece in the post-conflict period and still today. The focus will particularly lay on peace education as a centerpiece of reconciliation of societies after times of war. The literature review will focus on reconciliation, methods of reconciliation, and the role education plays in conflict resolution. The last part will focus on requirements for successful peace education. After that, the paper will focus on the circumstances that led to the peace education programs in Rwanda and Bosnia to be more or less successful. Since capturing the effect of peace education on society is difficult, this paper will look at the reach of the programs within the two countries. Bosnia’s programs were able to reach substantially more students with their program than Rwanda. This can be traced back to the development of each country as well as their economic state, which existing literature seems to underestimate. Without sufficient funding for schools and access to learning material, efforts of the government can only reach small parts of the population. Because of their development, Bosnia has a way better chance at implementing a successful peace education program than Rwanda.

Definitions and background information

What is reconciliation

Reconciliation is a widely used term in peace education and peacebuilding. It can be defined in changing the “motivation, goals, beliefs, attitudes, and emotions” of a conflict. Bar-Tal finds the creation and renewal of new “societal goals” as a key component of reconciliation. It requires participation from all major outlets of society like politics, media, and cultural leaders like churches and NGOs. NGOs especially can give economic assistance to members of society to reduce the negative sentiments within society (Bar-Tal, 2002). The goal is to build trust and prevent conflict from recurring. It is needed when sides struggle to overcome bitterness and grievances after violent civil conflicts (Bar-Siman-Tov, 2004.) The reason for reconciliation can be found in the aftermath of civil conflict. After violent conflicts end, opposite parties still have to live and work together. Reconciliation can help members involved in the conflict to be integrated back into society (Deutsch, 2021). Goldstone names four solutions for that reconciliation process. Either everyone is granted immunity from prosecution, the regular justice system handles the situations, a truth and reconciliation commission is established, or the international community takes action in the matter (Goldstone, 1996).

What are requirements for successful reconciliation?

Reconciliation is the goal of both truth commissions and education. In order for that goal to be reached, Bar-Tal finds “mutual recognition and acceptance [...] and mutual trust” as a necessary component. “Collective forgiveness and healing” have to be reached especially in conflicts with two-sided violence. Both sides need openness to learn about other perspectives in order to create a future that includes the past rivals. It requires a mass involvement from society to reach reconciliation after traumatizing and violent conflicts like genocide (Bar-Tal, 2009). In order for the interaction between both sides and at the end reconciliation to be successful, Deutsch names multiple requirements. Successful reconciliation requires “mutual security, mutual respect, humanization of the other, fair rules of managing conflict, curbing extremists on both sides, gradual development of trust, and cooperation”. There

needs to be an environment shaped in which open communication is possible and both victims and criminals feel safe to share their story (Deutsch, 2011).

Another step towards reconciliation is creating new relations in politics. A society cannot keep functioning under the same government under which crimes happened. Politicians need to be free and equal participants in the system in order to evolve from the past (Mazzei, 2011). It cannot be forced upon societies that are not ready for addressing the past. Reconciliation has to openly target the painful past while pushing for security, economic relations, and political cooperation (Bar-Siman-Tov, 2004). What role does education play in conflict resolution?

Education plays a huge role in conflict resolution. Through education, younger generations learn about the culture of conflict, how they identify with conflict, and how that may differ from their family's beliefs about the conflict. Education is a "major agent for socialization," and it has all the means for peacemaking and reconciliation (Bar-Tal, 2009). It can help to alter the worldview of generations, which helps the peace process and prepares them to live in a peaceful future without past grievances. Especially since school is one of the most powerful influences in children's lives and has all the resources needed like time, authority, consistency, mandatory attending, it should be used as a tool in the peace-making process (Bar-Tal, 2009). Johnson finds peace education or education as a whole as a tool of "long-term maintenance of peace," and it is a way of achieving consensual peace. Education gives the opportunity to children and can discourage them from joining violent groups. It is a form of reintegration into society and can be used as a practice to live out the peace and practically learn skills to achieve long-term peace. Children learn how to respect each other and gain skills to handle conflicts. Through education, common goals across groups create "positive interdependence" and a feeling of unity (Johnson, 2005).

For conflicts in which children were part of the violence as soldiers, education has another major role beyond just teaching peace. Education can serve as a tool to reintegrate children back into their society and foster the "prevention of youth's engagement" in violence. Wessells claims that children can be easily exploited as soldiers in ethnic conflicts. They are either coerced into joining militant groups, or they have other motivation like desperation, survival, abuses at home, revenge, past grievances, and the lack of access to education and jobs. Examples for this are the post-2002 fighting in Liberia where Human Rights Watch found that almost half of the soldiers were children. Likewise, nearly half of Revolutionary United Front in Sierra Leone were children. Even during the conflict, efforts to reintegrate these children back into their societies can help foster peace (Wessells, 2005).

In Bar-Tal's article on concepts and principles of peace education, he points out that peace, as a symbol, can be taught through schools. It is the only place where a government has access to a whole generation and the means to do so. Peace education is not only a tool that can be used after the civil conflict, but is implemented at all times. How peace education is approached models the politics, society, and economy of a whole nation. Through that socialization process of a generation, changes can be fostered within a society. Bar-Tal also names three social implications of peace education: the "condition-dependent nature of peace education, its dependence on social agreements, and its function as a social platform". In order for peace education to work, these implications have to be present in society (Bar-Tal, 2002). What are the requirements for successful conflict education?

In his article, Bar-Tal finds four political-societal conditions for successful peace education. Firstly, there needs to be progress towards peace within the society and a general support for the peace process and all means that come along. Then, Bar-Tal requires a condition of ripeness for reconciliation in the society. Lastly, peace education requires governmental and political support in order to be successful. Continuing, he also proposes educational requirements that have to be present for successful conflict resolution through peace education. There needs to be ministerial support in order for the peace education to get enough resources and means to properly fulfill their purpose. Another requirement is a well-defined peace education policy. The government should think through the methods, goals, and means that are being used in this lengthy process thoroughly which is supposed to last for centuries. Lastly, there needs to be enough authority given to the peace education in order for it to achieve anything (Bar-Tal, 2009). Another general requirement is "mandatory public education" to reach everyone in society. The schools have to be integrated by all members of society and all members have to participate in the process. The goal is to be introduced to colliding world views and to people the students would usually not interact with (Johnson, 2005).

Peace education can function through two methods, either through a direct peace education model or an indirect model. The direct model, like the name says, directly addresses the conflict and its causes. The main goal is to create a peace ethos within this targeted generation. In the lessons, students learn about the definition of conflict and peace, the peace process of their own conflict,

a presentation of the rival side and their viewpoint, an accurate representation of the conflict history, as well as learning how to have empathy for their opponents. The indirect model, on the other hand, educates on conflict-related topics without directly addressing the conflict at hand. Subjects like human rights, tolerance, ethno-empathy, conflict resolution, and reflective thinking are being discussed in this type of peace education method. It aimed towards long-term change in society's attitudes towards conflict (Bar-Tal, 2009).

In their discussion of creating lasting peace, David and Rodger Johnson list multiple steps towards successful peace education. First, as already mentioned before, there needs to be mandatory school attending. Second, mutual goals, cooperation, and support for each other need to be created in the schools. This can allow for "reconciliation, forgiveness, and giving up of a combat or victim mentality" in the students. Lastly, there is the decrease in prejudice through interaction with rivals. The interaction, teamwork, and equality they experience in schools transfers into their lives, and the goal is for them to find that empathy for their neighbors again and be able to move into the future without holding negative emotions against groups based on specific characteristics (Johnson, 2005).

Important here is to realize that different societies have different histories to deal with and different conditions within society. That is why the content of peace education differs extremely from nation to nation and can't be created as a global incentive. It requires legitimization within society and approval from parents. Therefore, schools cannot be the only outlet for peace education. There need to be other means like mass media or historical sites that bring across the same inclusive message (Bar-Tal, 2002).

The history of both genocides

The genocide in Rwanda is estimated to have killed between 800 to 500 thousand Rwandans from April to July of 1994, which left $\frac{3}{4}$ of the ethnic minority Tutsi dead. The ethnic cleansing was perpetrated by the ethnic majority Hutus, who resented and feared Tutsis since colonial times. Through force and intimidation, the Hutu government made huge parts of the population engage in the slaughter (Human Rights Watch, 1999).

The Bosnian genocide, on the other hand, was perpetrated by the Serbian government and its government against Muslims living in Bosnian territory. The Serbian government claimed it was liberating Bosnian Serbs and reuniting them with their homeland since Bosnia and Herzegovina was inhabited by Bosnian Muslims, Bosnian Serbs, and Bosnian Croats. It is estimated that around 100 thousand people were killed from 1992 to 1994, including Bosnian Serbs and Croats that opposed the ethnic cleansing agenda of the JNA (Toal, 2011; Holocaust Museum Houston).

Framework for case studies:

In the second part, this paper will take a look at the peace education efforts of Rwanda and Bosnia after their genocides in the 1990s. The implementation of peace education after civil conflicts is a difficult task for governments. This part will explore the approaches both governments used after the conflict ended. What resources did the government grant towards the peace education process, and did it have international support? Important to explore here is if there was societal support as well and how many people the peace education efforts reached. It will also further investigate what model of peace education, direct or indirect, introduced by Bar-Tal was used. This also includes looking at the content of the education, so if the focus was more on historic recertification or teaching skills to resolute conflicts in a peaceful matter and gain qualification for future jobs or reintegrate children back into society. Another focus will lay on the ripeness for implementing peace education as part of the reconciliation process.

After comparing the approaches of Bosnia and Rwanda, this paper will look at the differences and similarities between the two peace education efforts and how that led to the program being more or less successful. The question becomes which factors led to the peace education to be working better. Both countries experienced a traumatic genocide in which the civil population was heavily involved. These genocides were both centered around ethnicity, and the distrust and grievances in the population go back many years. Both genocides happened around the same time period, and, in both countries, the international community failed to get involved in time. They both count as one of the "failed" missions of the United States peacekeeping efforts. With this in mind, it seems like peace education efforts had the same starting point in trying to reconcile the population. This paper will look at two other variables that influenced the effectiveness of peace education. These are the quality of the education system and GDP, which

is connected to state resources. It will find that having a better education system and more state resources leads to peace education being more successful and reaching more people. The methods used in both Rwanda and Bosnia do matter, but, without having a general successful education system in place, even national efforts will fail.

Peace education in Rwanda:

After the brutal genocide in 1994, peace education was one of the tools for the Rwandan government on the road of reconciliation. In 2013, the Rwanda Peace Education Program (RPEP) was launched. Its goal was the promotion of “social cohesion, positive values- including pluralism and personal responsibility- empathy, critical thinking and action to build a more peaceful society” (Genocide Archive of Rwanda). It was a three-year collaborative effort between four local and one international partner from Sweden (Rwanda Peace Education Programme). It included everyone from school children, decision makers, and young people.

There are four main pillars of the program. The first one is the Education Outreach Program that initiates training of teachers, workshops in schools and communities, as well as debates in schools. It uses a story telling methodology to introduce the students to their painful past. The second part is the Kigali Genocide Memorial Education Program. At the memorial, school classes can take workshops which focus on social cohesion and personal responsibility. Then, there is the Genocide Archive of Rwanda, which gives access to material on causes, implementation, and consequences of the genocide. The last pillar is the Youth Champion Program that trains young leaders to help their communities and organize activities so that the effects of the program go beyond just the three years (Genocide Archive of Rwanda).

The RPEP also hosted forums about peace education where experts and government officials planned the integration of peace education into the national school curriculum. In the new curriculum, peace education is taught through multiple subjects. Part of the RPEP are also radio programming, education and training workshops, and lots of other events to engage Rwandans into the peace process (USC Institute for Visual History and Education, 2014). The weekly radio drama program has existed since 2004. It is free of costs and even reaches Rwandans that fled after the genocide to neighboring countries. It uses a storytelling approach and is testimony-based to educate Rwandans about their past and other elements of peace education. Ten thousand people have attended the workshops across Rwanda and about 32 thousand have attended the National Art Exhibition Tour. For the debates, RPEP counts 12 thousand participants, and the genocide Archive website has counted 150 thousand visitors. The website is especially valuable because it gives teachers the tools to integrate the genocide in their lessons without leaving them alone with the planning. This was supported by training teachers from all regions on how to integrate the new curriculum into their lessons so they would be able to help all of their colleagues with it. The new curriculum has been in place since 2016 and is supported by the Institute of Research and Dialogue for Peace that helps to review materials and methodologies across Rwanda schools (Rwanda Peace Education Programme).

Rwanda’s peace education was a national incentive with heavy involvement of the Rwandan government. The project started because of local organizations, but, with positive results, the government made an effort to include some of the peace education into all schools so more children could be reached. There is mandatory school attendance, but most Rwandans do not attend more than a third of that schooling. Compared to a population of roughly 12 million people, the effects on the population of peace education are relatively low. The government is trying to address old prejudice in school materials, but their resources can hardly provide for sufficient materials anyways (Human Development Reports, 2019).

The RPEP uses a combination of the direct and indirect education model. Their four main strategies include direct knowledge about the causes and history of the genocide through the Genocide Archive as well as indirect methods that focus on teaching civic values like critical thinking, conflict resolution, and empathy. By training individuals to become leaders in their community and incentivizing professional development, they not only focus on teaching values but also offer life skills that participants can use in their future career. The program uses a variety of options for Rwandans from debates, to interactive learning experience in the online archive or the memorial, to workshops and classical teaching for students in school. In a report put out by the REPEP about their achievements and stories, the Rwandans that interacted with the system were supporting the peace process.

Since the genocide time has passed, and with a new government, it might have been the right timing to start implementing peace education as a reconciliation effort (Rwanda Peace Education Programme). Still, it is difficult to implement a program nationally,

so it reaches lots of people when the government does not have the financial resources to do so. It seems to be effective and changing for the people it reaches, but this is only a fraction of the society, so the long-lasting effects might not be too high. It is difficult for a government to focus on peace education when there are fundamental developing issues like mortality rate, poverty, and broken infrastructure. Without the financial and governing means, peace education will continue to only impact a small percentage in the population and have no significant change on the people of Rwanda. For example, only about one third of the students in Rwanda have access to internet and could technically be able to reach the archive website (Human Development Reports, 2019). The program is planned out to be very effective and meets the criteria for a successful peace education, but it lacks the applicability for most Rwandans. It is unlikely that the program will be able to implement reconciliation through peace education throughout Rwanda.

Peace education in Bosnia

In Bosnia, there are many different programs running to bring reconciliation through peace education to the society. One example is the Genisis Project. It was set up in 1997 to educate about “tolerance and coexistence, children and human rights, child safety, violence prevention, peacebuilding, conflict prevention and resolution, gender equality and bullying prevention”. Since 2009, the project was implemented in divided primary schools. In Bosnia, there are segregated schools based on Bosnian and Croatian ethnicity, which some refer to as “two schools under one roof”. The goal of the Genisis Project in those schools is to decrease “prejudice and stereotypes and rebuild trust and confidence among major ethnic groups”. Children also learn about “freedom of speech, democracy, basic human rights and peaceful conflict prevention and resolution”. The project already reached 100 thousand children since it started (Peace Insights). The general objective of the program is to train students and staff of elementary schools to incorporate cooperation, respect, and tolerance in the classroom. Students work on critical thinking, problem solving, and communication. The project also offers a handbook for students and staff on how to successfully implement these goals in the classroom. Another part of their project are dialogue platforms for communities where daily challenges and solutions can be discussed (UNICEF, 2018).

A similar project that was implemented in Bosnia is the Education for Peace Program. It started in 2000, and the main goal of it was to transform the worldview and character of Bosnian participants. Their objective was for Bosnia to recognize the “oneness of humanity and the earth, the fundamental importance of unity in diversity, the application of standards of justice and equality”. The framework of this project can be applied in families, schools, businesses, NGOs, media, and governments. In Bosnia, peace was used as a framework for education. Teachers and schools’ staff were trained in peace concepts in class and interaction between participating schools was encouraged. Peace as a concept was integrated into all lessons, and regional peace events were organized where students could present their peace projects to their communities. The focus here was especially on art as a form of self-expression. Another part of the project were seminars for teachers where specific questions on the genocide could be asked. This equipped the staff with knowledge on the topic while giving them the opportunity to process their own experience with the past (Clarke-Habibi, 2005).

The Bosnian efforts for peace education lack national coordination. There is no national effort that reaches all Bosnian school children equally, but many different programs with local importance. The Education for Peace Program and the Genisis Project both reached a relatively large amount of the school population since there are only around 3.3 million Bosnians. The Education for Peace Program is the one with the most governmental support, and the goal of the education ministries was to implement the peace related topics in all schools in Bosnia (Changemakers, 2017). There is still a huge separation between the major ethnicities in Bosnia, and stereotypes and prejudice hold up until today. This was visible in the schools when the peace education programs started and children that weren’t even alive at the genocide had prejudice against kids from another ethnicity. The school system still seems segregated with the different ethnicities having different curriculums in their own languages, sometimes even in the same school (Tolomelli, 2015). Therefore, the necessity for peace education is very high, and the government has recognized that. The timing of the peace education is good since the fighting has stopped between the parties and people have had some time to process the violence. Especially since the internal conflict seems to be present to this day, it was necessary for the government to enact some change in their society.

One might even argue that the implementation of a national curriculum change is past due and should have been the focus of the Bosnian government earlier. When it comes to governmental resources, Bosnia is in a better position than Rwanda. Since schooling

is mandatory in Bosnia and the majority of Bosnians attend school for most of the expected 13 years, the peace education has the conditions to be very successful (Human Development Reports, 2019). The two different projects introduced in this paper used an indirect approach to peace education. The focus of their programs was to teach values like peaceful conflict resolution, tolerance, diversity, and human rights. Also present was the connection to artistic expression for children to use their knowledge and articulate themselves. Since the divide between ethnicities was still present years after the conflict it might be helpful for the government to invest into reducing polarizing content out of Bosnians everyday life. The education system itself can serve as a successful preparation for the professional world. Bosnia is way more developed in comparison to Rwanda and does not need the peace education to be more than just teaching values to foster peace.

Discussion:

As mentioned earlier, there are quite a few similarities between the genocide in Rwanda and Bosnia. These will be the constant variables which seemed to have no impact on the success of the peace education programs. Summarizing the history of both genocides, they were already described. In both cases, the population was heavily involved. In Rwanda, the government coerced the Hutu population to participate in the killings, and when individuals were opposing, they were killed as well. In Rwanda, Croats, Serbs, and Muslims were displaced and killed, and parts of the Serbian population were involved through the SDS. This also points to the second constant: the focus on ethnicity in the conflict and the violence that was directed at one specific ethnicity. In Rwanda, these were the Tutsis, and, in Bosnia, the Bosnian Muslims. The time period in which the killings happened are also the same. The Bosnian war happened from 1992 to 1994, and Rwanda's genocide happened in 1994, but the buildup to the attacks started in 1990. Both conflicts were rather short but had a long history of tensions and grievances that build up to the escalation. Lastly, both cases count towards one of the failed UN peacekeeping missions in which the international community failed to protect the local community. In Rwanda, Belgian military forces left the Tutsi population vulnerable shortly before the killings began, and, in Bosnia, the Srebrenica massacre that was supposedly a UN safe zone couldn't help to protect Bosnian Muslims (McGreal, 2015).

What seems to be differing between the two is the development state of the country, which impacts both the quality of the education system and the Gross Domestic Product (GDP) or state resources. This will be the independent variables that impact the dependent variable, in this case, the success of the peace education programs. The Human Development Index (HDI) of Rwanda and Bosnia in 2000 portrays the difference accurately. In 2000, Rwanda's HDI was 0.341 and Bosnia's was 0.68. The HDI is a "simple unweighted average of a nation's longevity, education and income and is widely accepted in development discourse". It is claimed that it captures development better than a strictly economic measure like the GDP because it takes other important development factors into account (Human Development Reports, 2019). The GDP captures the total monetary value of everything produced (goods and services) within a year in a country. In 2000, the GDP per capita, which is basically the GDP divided by the population, was 261 dollars for Rwanda and 1467 dollars for Bosnia (The World Bank, 2021). These indexes show that the development within the countries was at a totally different point when peace education programs were implemented. This also includes the state of the education system as mentioned in the description of the peace education methods above.

Measuring the effectiveness of the peace education programs implemented in Bosnia and Rwanda is almost impossible. Research suggest that peace education programs cannot be evaluated on "whether it brings peace to the world, but rather by the effect it has upon students" (Harris, 2003). In order to develop a metric to capture the impact of the peace education programs on students, this paper will use the reach of the programs within society. In that regard, this paper will take into account how many students the program was able to reach throughout society and the time frame that students usually are in contact with peace education in schools or programs from non-governmental organizations. This can be an effective measure of success because encountering the idea of peace through indirect and direct models can at least challenge peoples' thinking patterns in regard to the genocide. If that challenge actually changes, beliefs and attitudes about peace are less certain, but starting the thinking-process with as many people as possible is a desirable outcome.

Following the dependent variable, 'success of peace education programs', it can be impacted by more than just how many people it reaches. There are other causes of success of the peace education programs that need to be considered. The program design and educational delivery may impact how much of the ideas introduced in the exercises stick with students. Here, it is important to look at when the direct or indirect model of peace education was used and if it was appropriate for the population at that time. How trained teachers are in delivering the ideas taught in the program is also crucial to the success of the program. The reach of

programs is certainly also impacted by mandatory schooling and literacy rates within society. Illiteracy is connected to mandatory schooling and quality of education. In countries where not all of the population go to school or go to school for an extended amount, the percentage of illiterate population is higher. When high parts of the population are illiterate, it is substantially more difficult to teach about peace ideas. In order for peace education to work, the students need to be able to understand the material and have the ability to work with it. If students cannot read and write, peace education comes second to that need to improve that. All the materials are useless without that skill. Lastly, the social and political climate is important to the success of peace education. Literature points to the ripeness within society to start peace education. The government and society need to be ready to address the painful past and be able to admit to mistakes. On the other hand, they also need to be ready to forgive and to give space to victims of the conflict for them to feel safe to share their stories and interact with the rest of society. The government also needs to be willing to use their resources for the peace education programs. Having the economic resources as a government is one thing, but they also need to be allocated to these programs in order for them to be successful.

With this background information in mind, the results of peace education efforts in both countries varies. Johnson and Bar-Tal both point to the importance of the government in order to achieve positive outcomes. The government needs to support the initiative and it needs the resources to successfully do so (Bar-Tal, 2009; Johnson, 2005). Adding to this, this paper points to the importance of development of a country to succeed in reconciliation. Rwanda might have had the better approach in implementing a national scale program, but because of lack of resources and a struggling education system, they were unsuccessful in reaching major parts of Rwandans. Rural areas that are severely behind in development are unable to join reconciliation efforts because of missing funding. Bosnia, on the other hand, is further developed. Though they chose a more local approach with multiple programs throughout the country, they were able to reach much more children with their initiative. This can be traced back to their development scale. Their education system is reliable, and the majority of children attend school for up to 13 years. Their government has more resources available which makes schooling better. Children have access to better resources like computers and the internet or a diverse number of books. The Bosnian system struggles in other areas than Rwanda because of their development. While Rwanda is dealing with poverty and mandatory schooling, Bosnia struggles to unite its children as they are still segregated in their schooling. They have the resources to do so, but there is no nationwide program in place in order to teach children about their history and how to deal with conflicts in general. The programs that have been implemented are successful in reaching the population. By the metric introduced earlier, this means that the peace education program of Bosnia can be considered more successful than the peace education program in Rwanda. The better development and more resources the Bosnian government has available lead to them reaching students all across the country. Rwanda, on the other hand, has less of these resources and therefore struggles to reach students that live in rural parts of the country. They lack resources in these areas and have other focuses in school in these areas.

	Rwanda	Bosnia-Herzegovina
GDP in 2000	2.069. billion	5.506 billion
Population in 2000	7.9 million	3.7 million
GPP per capita in 2000	261 US\$	1467 US\$
GDP per capita in 2020	762 US\$	5387 US\$
HDI in 2000	0.341	0.68
Data from Human Development Reports and World Bank		

Conclusion

Bosnia and Rwanda both have a history of a brutal genocide that had ethnic tensions as a cause. Still, the two countries are at different development levels and have chosen different approaches to peace education. Rwanda has implemented a mixture of indirect and direct teaching methods but lacks the financial and administrative means to implement their Rwanda Peace Education Program on a national effective scale. Bosnia chose an indirect approach to peace education and has reached a larger percentile of its students with their different programs. Still, the peace education project seems to lack national coherence with multiple programs implemented at the same time. The necessity of peace education is still present in both countries and should further be developed

as part of a reconciliation strategy. Both countries have challenges to a successful implementation of peace education. In Rwanda, there are fundamental issues like poverty, urbanization, and lack of resources that make Rwanda a vulnerable nation. It is logical that there can be fewer financial means allocated to peace education, and, therefore, the ability to reach a majority of the society is low. This shows that the development of a country has a huge impact on its ability to reconcile their population. They are dependent on donations from the international community and, even then, rural areas can hardly be reached. In Bosnia, on the other hand, the country is further developed, but, since the genocide included at least two different countries, it is impossible to coordinate a functioning peace education system in which both governments cooperate. Bosnia's struggles also with segregation within their country, which shows how much reconciliation still has to be done. This paper has shown that how developed a country is and the state of their economy impacts the success of peace education programs by being able to reach more people. Rwanda struggles with reaching more of their population because of lack of development and state resources. Bosnia's programs on the other hand were more successful in reaching people because of its general development and economic resources.

Work Cited:

- Bar-Siman-Tov, Yaacov. (2004). *From Conflict Resolution to Reconciliation*. Oxford University Press. Retrieved at: https://books.google.com/books?hl=en&lr=&id=wOo8PiX8PWMC&oi=fnd&pg=PR9&dq=conflict+resolution&ots=-cRXXCRzgp&sig=DHIIdfKQeoRd_wEFpftnTIB6eWkg#v=onepage&q=conflict%20resolution&f=false
- Bar-Tal, D., & Rosen, Y. (2009). Peace Education in Societies Involved in Intractable Conflicts: Direct and Indirect Models. *Review of Educational Research*, 79(2), 557-575. Retrieved at www.jstor.org/stable/40469048
- Bar-Tal, Daniel. (2002). The Elusive Nature of Peace Education. *Peace Education: The Concepts, Principles, and Practices in the World*. 27-36. Retrieved at: <https://www.tau.ac.il/~daniel/pdf/39.pdf>
- Changemakers. (2017). *Education for Peace: Building a Civilization of Peace in Bosnia and Herzegovina*. Retrieved at: <https://www.changemakers.com/competition/entrepreneur-ing-peace/entries/education-peace-building-civilization-peace-bosnia-and>
- Clarke-Habibi, S. (2005). Transforming Worldviews: The Case of Education for Peace in Bosnia and Herzegovina. *Journal of Transformative Education*, 3(1), 33–56. <https://doi.org/10.1177/1541344604270238>
- Deutsch, Morton; Coleman, Peter T.; Marcus, Eric C. (2011). *The Handbook of Conflict Resolution: Theory and Practice*. second edition. Retrieved at: https://www.google.com/books/edition/The_Handbook_of_Conflict_Resolution/rw61VDID7U4C?hl=en&gbpv=1&pg=PR11&printsec=frontcover#v=onepage&q=conflict%20resolution&f=false
- Genocide Archive of Rwanda. Rwanda Peace education Program (RPEP). Retrieved at: <http://genocidearchiverwanda.org.rw/index.php/RPEP>
- Goldstone, R. J. (1996). Justice as tool for peace-making: Truth commissions and international criminal tribunals. *New York University Journal of International Law and Politics*, 28(3), 485-504. Retrieved at: https://heinonline-org.ezproxy.csuueblo.edu/HOL/Page?collection=journals&handle=hein.journals/nyuilp28&id=495&men_tab=srchresults
- Haslam, Meghan. (2018). *Growing Peace Through Education in Bosnia*. Global research Institute. Retrieved at: <https://www.wm.edu/news/stories/2018/growing-peace-through-education-in-bosnia.php>
- Harris, Ian. (2003). *Peace Education Evaluation*. Department of Educational Policy and Community Studies, University Wisconsin-Milwaukee. Retrieved at: <https://files.eric.ed.gov/fulltext/ED480127.pdf>
- Holocaust Museum Houston. *Genocide in Bosnia*. Retrieved at: <https://hmh.org/library/research/genocide-in-bosnia-guide/>
- Human Development Report. (2019). Rwanda. Retrieved at: <http://hdr.undp.org/en/countries/profiles/RWA>
- Human Development Report. (2019). Bosnia and Herzegovina. Retrieved at: <http://hdr.undp.org/en/countries/profiles/BIH>
- Human Rights Watch. (1999). *Leave No One To Tell the story: Genocide in Rwanda*. Retrieved at: <https://www.hrw.org/reports/1999/rwanda/>

- Johnson, D., & Johnson, R. (2005). Essential Components of Peace Education. *Theory Into Practice: Peace Education*, 44(4), 280–292. Retrieved at: https://doi.org/10.1207/s15430421tip4404_2
- McGreal, Chris. (2015). What's the Point of Peacekeepers When They Don't Keep the Peace? *The Guardian*. Retrieved at: <https://www.theguardian.com/world/2015/sep/17/un-united-nations-peacekeepers-rwanda-bosnia>
- Mazzei, J. (2011). Finding Shame in Truth: The Importance of Public Engagement in Truth Commissions. *Human Rights Quarterly*, 33(2), 431-452. Retrieved at www.jstor.org/stable/23016021
- Peace Insights. Genesis Project, Conflicts: West Balkans. Retrieved at: <https://www.peaceinsight.org/conflicts/western-balkans/peacebuilding-organisations/genesis-project/>
- Rwanda Peace Education Programme. Towards Sustainable Peace. Retrieved at: <https://www.aegitrust.org/wp-content/uploads/2017/12/Stories-of-Peace-UPDATED.pdf>
- The World Bank. (2021). Retrieved at https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?name_desc=true
- Toal, G., & Dahlman, C. (2011). *Bosnia remade ethnic cleansing and its reversal*. Oxford University Press.
- Tolomelli, A. (2015). Two schools under one roof. The role of education in the reconciliation process in Bosnia and Herzegovina. Dipartimento di Scienze Dell'Educazione «Giovanni Maria Bertin» – Università di Bologna.
- UNICEF. (2018). Educational trainings within the project “Dialogue for the Future” realized in 39 schools in Bosnia and Herzegovina. Retrieved at: <https://www.unicef.org/bih/en/press-releases/educational-trainings-within-project-dialogue-future-realized-39-schools-bosnia-and>
- USC Institute for Visual History and Education. (2014). Rwanda Peace Education Program Moves Closer to Integration into National Curriculum. Retrieved at: <https://sfi.usc.edu/news/2014/12/7900-rwanda-peace-education-program-moves-closer-integration-national-curriculum>
- Wessells, M. (2005). Child Soldiers, Peace Education, and Postconflict Reconstruction for Peace. *Theory Into Practice*, 44(4), 363-369. Retrieved April 22, 2020 at: www.jstor.org/stable/3496980

Modern Presidency and Separation of Powers

Zuzanna Przygoda

ABSTRACT

Separation of powers plays a key role in preventing abuse of power in American government. This paper evaluates the existing research on the subject of the powers of the U.S. executive branch in relation to the legislative and judicial branches. The opinions on whether presidency has grown too strong, or perhaps is not strong enough, vary, but researchers tend to agree that by putting enormous responsibility on one person only in the executive branch, the Constitutional framers made the presidency unique. This explains why concerns of abuse are more prevalent and understandable in the context of this branch than the others.

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Introduction

Separation of powers is a fundamental principle in American government. The government is divided into three separate branches, so that power is not concentrated in one place. This allows for a system of checks and balances, to prevent abuse of power from happening. While in theory each branch has a distinct area of authority, in reality the boundaries are much more blurred between the branches. The system of checks and balances, as well as certain precedents cause those areas of authority to overlap. Since the branches are supposed to be equal, this overlapping authority makes sense. For example, if the executive was only supposed to execute laws made by the legislative, without any original input it would become its subordinate. The mechanism that is supposed to keep the branches equal is a double-edged sword however, as without clear boundaries, one of the branches can disproportionately overstep its authority. As the president is the head of the executive branch, it is important to examine the president's power in relation to the other branches. As the issue is very important, a variety of articles exist that examine it.

This research critique will assess the state of existing research on the topic of presidential power. Six articles will be assessed in this paper. The research approach taken for these articles varies broadly. The opinions expressed also differ, but there are some common themes that can be seen. In today's polarized political world it is important to hear the opposing arguments, perhaps now more than ever. The articles assembled here include opinions from both sides and from diverse authors that include political scientists, law scholars, Supreme Court scholars and a more subjective source from within the Presidential Administration. Due to the holistic approach the formation of a clearer personal opinion on this matter is possible. The matter of presidential power has been important for a long time, as people have worried about the increase of power in the hands of Franklin Delano Roosevelt, and even earlier during Andrew Jackson's presidency, and is even more relevant today, in 2021.

Overlapping authority and clashes between the branches

The research tends to agree that clashes between the branches are inevitable. After all, the system of checks and balances is meant to keep one branch from abusing its power or dominating the others. In cases where authority is overlapping, there have been disagreements over what which branch can do. An example of such a disagreement is the historical Supreme Court case of *Marbury v. Madison* (1803). This landmark case established the principle of judicial review – simply put, the ability of the Court to decide whether a law or government's decision is constitutional. A more recent example is the fact that impeachment is more frequently considered as a tool that can be used against presidents. In the history of the United States, three presidents have been impeached, but as of yet, none have been convicted. The first one was Andrew Johnson in 1868. In the latter part of the twentieth and early twenty-first centuries, two presidents have been impeached, Bill Clinton and Donald Trump, but more faced the threat of an impeachment. Nixon would have been impeached if he had not resigned from office before that. President Obama was never impeached, but some of his opponents suggested using this method to remove him from office. The most memorable reason some people have argued an impeachment could be based upon was the false claim that Obama was not born in the United States. Increased use of impeachment can probably be seen most clearly by the fact that Donald Trump has been impeached not once, but twice, something that has never happened to American president before. Trump's second impeachment is especially interesting, as it established significant precedent, namely the possibility of convicting a president whose term has ended. There has already been one attempt to impeach President Joe Biden - despite his term starting only recently - by Representative Majorie Taylor Greene. Greene wanted to impeach him for things he allegedly did as vice president.

The power of the President

There is no doubt that the President of the United States holds great power. As political and legal scholars Lee Epstein and Eric A. Posner say: "scholars of presidential power agree that the presidency is an extraordinarily powerful institution, and that it is a far more powerful institution today than it was in the past" (Epstein and Posner, 2018, p. 830). In the other two branches the power and responsibility is more divided between individuals: nine Supreme Court Justices, and even more so between the 535 members of the Congress. While the president of course does not do everything alone, he or she, just one person, is the head of the executive branch. This, as well as more power being delegated to the president in recent times by the other two branches makes it understandable that when Americans worry about the abuse of power, the executive branch is the one that gathers the most attention and is spoken about the most.

Of course, there are different approaches and interpretations of what the responsibilities of the president are and how far his or her authority goes.

Arguments for strong presidency

The first article discussed, *The Role of the Executive* by William P. Barr, expresses the opinion that while the president holds a lot of power, it is exactly what the Framers wanted. This source is an article based on a lecture given by Barr. As Attorney General under president Trump, Barr gives an inside view on the issue, from the perspective of the president and people around him. That also causes the view presented to be more subjective – perhaps partisan. While most of the time it is said that the executive branch has gained power over the other two branches in recent times, Barr presents a different opinion. He speaks of the judiciary and the Congress encroaching on the president’s power. He goes as far as to say that the executive has fulfilled the expectations of the Framers “more than any other branch” (Barr, 2020, p. 606).

Barr addresses the issue of most people having the impression that the executive branch is the one encroaching on the power of the others. He explains that there exists a misunderstanding about who the Framers saw as most likely to abuse power. The common understanding is that they did not want an executive that would be too strong, because they feared it could turn into monarchy. Barr argues however, that by that time monarchical power was in decline. Parliamentary power was becoming the most powerful one. Therefore, Barr argues, “by the time of the American Revolution, the patriots well understood that their prime antagonist was an overweening Parliament” (p. 607). Later on Barr states that there is simply a tendency to see the legislative and judicial branches as the “good guys”.

Barr further argues that under the United States’ first founding document, the Articles of Confederation, there was no executive that would be fully independent from Congress. Framers saw the weaknesses of the Articles, and a too weak executive was one of them. Under the Articles the central government was meant to be weak, so the Congress did not have the power to tax, and while every state had its own militia, the central government was unable to assemble an united military, which caused the United States to be vulnerable on the international stage. The United States had to be taken seriously as a whole. Without a strong leader, there existed an incentive for foreign powers to establish relations with individual states, instead of the Union as a whole. They saw the need to establish a strong executive leadership in the new Constitution during the constitutional Convention of 1787. Barr says that after the Revolution many states created their own constitutions with weak executives, subordinate to legislatures. “Where this had been the case, state governments had proven incompetent and indeed tyrannical,” (p. 608) Barr argues.

Barr backs up his claims by quoting or referring to several prominent figures, such as Thomas Jefferson or English philosopher John Locke. In one such instance, he quotes how according to Jefferson the matter of foreign affairs was “executive altogether”. This connects to the fact that the president indeed has much more of a free hand when dealing with foreign matters instead of the domestic ones. Barr highlights it several times how important it is that the president has the ability to make decisions fast.

Most of the arguments made by the author mentioned above seem compelling. It is important to note that the executive is not the only branch that could possibly become tyrannical; the legislative branch also has that possibility, even if it seems less likely. There is another strong argument that he makes that the Framers could divide the executive between multiple individuals, but chose not to, to make it possible for decisions to be made quickly and to make the leadership strong. In Federalist Paper No. 70 Alexander Hamilton gave convincing arguments supporting unitary executive. According to Hamilton, it would help ensure accountability in government, as well as sufficient “energy”. That last word is used frequently by Hamilton in relations to the executive in Federalist No. 70, claiming for example, that: “energy in the executive is a leading character in the definition of good government”. Obviously the Framers saw the problems that arose from a too weak executive under the Articles of Confederation, and they could have feared a too strong legislature. But that does not mean they did not fear a too powerful executive, as well. I think they feared that any of the three branches could become too overreaching, and tried to balance the three.

While Barr’s arguments are compelling, they also look from one perspective only, and consider the situation favorably for the executive. It is interesting that in the later stages of the article, where Barr speaks of the judiciary and legislative branches encroaching on president’s power, he mostly talks of situations when it happened to President Trump. For example, he names “Senate’s unprecedented abuse of the advice-and-consent process” (p. 616) as an encroachment by the legislative branch. As an instance of the judiciary doing so, Barr says that the judicial branch “has appointed itself the ultimate arbiter of separation-of-powers disputes between Congress and Executive” (p. 622). It is not surprising, with Barr serving under Trump. Therefore, even if it was objectively true that the other branches did in all those instances encroach Trump’s power, it would be one example. Barr’s argument would be stronger if he did not depend so strongly on just one president to back up his claims. However, like stated earlier, Barr being

Attorney General under Trump, this is the example he not only has the reason to talk about, but also is the most familiar with. Moreover, he has an incentive to show presidential power in a positive light. This becomes even more obvious knowing that he was chosen to replace Jeff Sessions as Attorney General because Barr wrote favorably about presidential power.

Barr's article is not the only one that questions the common idea of presidential power growing constantly. It is important to consider how Constitutional scholars view this matter, as Barr is not one, he is a practitioner of the law. The article *The Decline of Supreme Court Deference to the President* by Lee Epstein and Eric A. Posner also questions this point of view. The authors point to a very important question that has to be answered when considering this topic: "how exactly do we measure presidential power?" (Epstein and Posner, 2018, p. 834) The authors also say that "scholars often disagree about whether the president is very powerful or very weak" (p. 834). They explain that it might depend on whether one looks at a president's successes or failures. Those might paint very different pictures of presidential power.

Epstein and Posner state clearly that their measurement of presidential power is based on president's win rate, or rate by which the President's preferred ruling 'wins', in the Supreme Court. This statement adds credibility, as it establishes specific criteria. The authors do not try to take every variable into account. Instead, they measure presidential power in this specific area. They focus on the relationship just between the executive and judicial branches. This provides for a better clarity of research.

The article states that presidents have advantage in disputes with private litigants. However, their research of the success rate showed that president's success rate in the Supreme Court peaked during the Reagan administration, and has been declining steadily since then. To support their claim that the success rate of presidents in the Supreme Court is declining, the article gives the percentages for George H.W. Bush, Clinton, George W. Bush and Obama – 70%, 63%, 61%, 52%, respectively (p. 833). Presented like this, the drop in rate is evident.

This puts into question the idea of presidential power being constantly on the rise. The authors then speculate that it may be that scholars tend to focus on the most noticeable or loud events while disregarding the more dull events in governing, and that is where the idea of presidential power growing so disproportionately came from. They give compelling examples of three presidents: Clinton, George W. Bush and Obama. While the article focuses on executive and judiciary branches, these examples touch upon legislative, also. In the case of Clinton, he went to war with Serbia in defiance of Congress, but was not able to implement key elements of his agenda domestically. Bush could use power aggressively against Al Qaeda, but "relied for authority on an enormous amount of new legislation enacted by Congress while succumbing to congressional pressure over coercive interrogation and other policies where there was disagreement" (p. 833).

These examples, but Clinton especially, fit in well with the fact that the president usually has more freedom in how he acts in the matters of foreign policy. A similar theme, although in a different context, was shown in Barr's article also. The examples of several presidents given by Epstein and Posner make their point convincing, as well as interesting.

Considering the fact that the Supreme Court now has six justices who are considered more conservative, and only three with more liberal leanings, this trend is likely to continue. As President Joe Biden is a Democrat, the six conservative justices are likely to have opinions that differ from his. Biden being pro-choice and wanting to expand health care access are just two examples. The trend might have changed, however, if Donald Trump won reelection.

George Washington and Supreme Court – historical separation of powers precedent

The article *The Historical Presidency: Competing Conceptions of the Separation of Powers: Washington's Request for an Advisory Opinion in the Crisis of 1793* by Nicholas C. Starr also deals with the relationship between the president and the Supreme Court. The author examines the situation that had arisen between President Washington and the judicial branch. When Washington applied to the Supreme Court for an advisory opinion, the Supreme Court refused to provide one. This set an important precedent in the relationship between the two branches of government. As Starr puts it: "Washington's request and the Court's refusal bear directly on fundamental issues regarding the purpose and practice of the separation of powers" (p. 603), setting a boundary between the branches. In many other situations the boundaries are more blurry. Two articles discussed next explain the consequences of such ambiguity.

Ambiguity of powers and potential for abuse

The article *The Recommendations Clause and the President's Role in Legislation* by Benjamin J. Schwartz tells a different story than the previous ones. He writes about the Recommendations Clause and how its “role has outgrown its design” (Schwartz, 2020, p. 815). Recommendations Clause gives the President the power and duty to recommend to Congress measures that he or she deems “necessary and expedient” – for example, but not exclusively, through the State of the Union speech. “The Recommendations Clause gives the President the discretion to judge what measures are necessary and expedient” (Schwartz, 2020, p. 773). He claims that using the Recommendations Clause to exercise negative executive power was never what the Framers had in mind. He gives recent examples of presidents Obama and Trump, who used the clause this way. The examples are well chosen, as this shows that presidents from both major parties have done so, demonstrating that it is not a tactic specific either for Republicans or Democrats. This also shows the effect of precedent and connects to how a power once assumed by president rarely goes away from the future presidents. Another thing that this article shows is how ambiguity can help the president extend his or her powers.

The article *Unilateral Action and Presidential Power: A Theory* by Terry M. Moe and William G. Howell deals with the role of ambiguity as well. The authors ask an important question: what are the foundations of presidential power? They quote Richard Neustadt, a preeminent political scientist who specialized in American presidency and advised several presidents, including Harry S. Truman and John F. Kennedy. Neustadt asked the same question about the foundations of presidential power in the 1960s, and came to the conclusion that the strength of presidential power does not come from formal power, but that the foundation of presidential power is personal, or that it depends on an ability to persuade other political actors to follow his or her agenda. The authors then say that Neustadt’s notion of personal presidency is on the decline, as it “seems increasingly out of sync with the facts” (Moe and Howell, 1999, p. 851). They say that there is a lot of research on presidential power that focuses on specific formal powers. But their article shifts that focus onto unilateral action.

Unilateral action is so powerful, they argue, specifically because it is not specified in the Constitution. Because Article II, specifying Presidential powers, is ambiguous, presidents can push that ambiguity to expand their powers. Moe and Howell say that this is a major force in “making modern presidency modern”. While it is the legislative branch that is supposed to make laws, thanks to unilateral action presidents can and do make laws of their own. Some of those laws and actions can be significant, like the examples of the Louisiana Purchase, or freeing of the slaves.

Their argument is a very interesting one. It does not necessarily contradict Neustadt’s, however. Taking into account that Neustadt made his statement nearly forty years later, the situation has changed. The presidency had to rely more on the personality of the president in the 1960s, but by the 1990s when Moe and Howell wrote, the power relies to a greater degree on unilateral action. Moe and Howell indeed say that Neustadt’s theory is growing out of sync with the facts over time, so it might be that it is just becoming obsolete. Most often, a power once given to the president goes on to his successors. So as the presidents pushed boundaries of ambiguity over time, their successors could depend on unilateral action more and more. One notable exception from the rule is the War Powers Resolution, an attempt by Congress to take back some of the president’s power. Most of the time however, it goes the other way around.

Moe and Howell state that “neither Congress nor the courts are likely to stop” presidents from expanding their powers, because of the nature of their institutions. This statement is contrary to articles by Epstein, Posner and Barr. They also say that “there is presently a small empirical literature on presidential lawmaking centered on executive orders” (Moe and Howell, 1999). More research examining that would definitely be beneficial, specifically concerning presidents Obama and Trump, and possibly president Biden in the future.

This article therefore shows how ambiguity allowed for a shift in the basis of presidential power, which once was grounded in persuasion and now relies much more on unilateral tools. Such a shift may be judged as either good or bad, depending on the point of view, but the most important thing is that such a shift occurred in the first place. This illustrates that the ambiguity allows for multiple interpretations of what counts as a president’s responsibility. Presidential power has changed from what it was several decades ago, and that means that it can continue to change in the coming years. Presidential power is influenced by precedent and how the rest of the society reacts to behaviors of subsequent presidents.

Limits of unilateral powers

The last article, *Unilateral Powers, Public Opinion, and the Presidency* by Andrew Reeves and Jon C. Rogowski, addresses the limitations in the literature cited by Moe and Howell. It shows the limits of presidential unilateral powers. According to the authors, unilateral powers are limited because of public opinion. Specifically, the fact that unilateral powers have usually low public support.

The authors use several surveys to support their claim. This article is unique in that it shows that that power of a branch of government can be constrained not only by the other two branches and the system of checks and balances, but also by the general public. Reeves and Rogowski also say that “voters distinguish the president from the presidency”. The public’s attitudes towards unilateral presidential powers are linked with the general approval of the president. “Presidential approval is associated with increased support for unilateral action while stronger beliefs in the rule of law are associated with lower support for unilateral action”, (Reeves and Rogowski, 2016).

However, because the article is from 2016, the surveys are about president Obama. It would be interesting to see how surveys would look like in relations to president Trump. Obviously the public’s opinion on president Trump himself and opinion on his policies were interconnected. It played a big part in him not winning a reelection. It also connects to the previous study about Neustadt’s idea of personal presidency. Moe and Howell argue that it is on decline. But it is hard to claim that personality does not play an important role for presidents at all now. It plays an important role in establishing public opinion on the president, and it is also important for presidential candidates to become visible enough among others to be seen as a leader in the first place.

Presidents Obama and Trump, as well as presidential candidate Hillary Clinton all evoked strong emotions among voters, and their personalities played a big role in that. While people can have strong opinions on president Joe Biden, he seems more amicable than Trump on some issues. Those include immigration as well as economic issues such as COVID relief programs, or raising minimum wage. As he said in his victory speech, he does not want to deepen the rift in an already strongly polarised nation. Perhaps it is that the voters got too tired of candidates with too aggressive approaches.

Conclusion

As stated at the beginning of this paper, opinions expressed in the articles vary greatly. The conclusion on whether presidential power is too strong depends largely on what facts are emphasized. Both sides can put forth convincing arguments. In the public opinion the viewpoint that the Presidency is too strong seems more prevalent. Some of the claims in the articles saying otherwise might therefore be surprising. Despite the variety of opinions, many ideas connect, however. The Presidency is unique and its power is complex. It might be its uniqueness among the branches that explains its place in the spotlight when it comes to concern about separation of powers.

While some arguments state that the powers of the Presidency have not expanded as much as it is often perceived, as Barr, and to a lesser degree Epstein and Posner suggest, enough evidence has been presented to show that at least the potential of abuse of power in the executive branch is very real – as explained in Schwartz’s article. Therefore, the aforementioned place in the spotlight seems well deserved.

References

- Barr, W. P. (2020). The Role of the Executive. *Harvard Journal of Law & Public Policy*, 43(3), 605–631.
- Epstein, L., & Posner, E. A. (2018). The Decline of Supreme Court Deference to the President. *University of Pennsylvania Law Review*, 166(4), 829–860.
- Moe, T. M., & Howell, W. G. (1999). Unilateral Action and Presidential Power: A Theory. Retrieved from <http://home.uchicago.edu/~whowell/papers/UnilateralAction.pdf>
- Reeves, A., & Rogowski, J. C. (2016). Unilateral Powers, Public Opinion, and the Presidency. *Journal of Politics*, 78(1), 137–151. <https://doi-org.ezproxy.csupueblo.edu/10.1086/683433>
- Schwartz, B. J. (2020). The Recommendations Clause and the President's Role in Legislation. *University of Pennsylvania Law Review*, 168(3), 767–815.
- Starr, N. C. (2015). The Historical Presidency: Competing Conceptions of the Separation of Powers: Washington's Request for an Advisory Opinion in the Crisis of 1793. *Presidential Studies Quarterly*, 45(3), 602–618. <https://doi-org.ezproxy.csupueblo.edu/10.1111/psq.12212>